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INFORMATION TECHNOLOGY IN BUSINESS PROCESS REENGINEERING - EXPERIENCES OF FINNISH COMPANIES

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ABSTRACT

Business process reengineering (BPR) has become an important item in the management agenda during the past five years. A recurring claim in the BPR literature is that information technology (IT) has an essential enabling role, but clearly, a debate continues. Furthermore, the link between the information technologies used and the process changes achieved seems rather weak. The somewhat contradictory opinions and lack of empirical evidence call for further research in this area.

In this study, our objective was to clarify the role of information technology in business process reengineering. We focused on examining the general importance of information technology, its usage, and impacts on business processes.

To meet our objectives, we first reviewed the previous literature to construct a descriptive model of the role of information technology in reengineering. Based on this model we formulated the research questions. Then, as a part of a larger research project, we carried out a two-phase mail survey and some structured interviews during 1995. This study reports experiences from 14 Finnish reengineering efforts.

We found that in these Finnish reengineering efforts, as suggested by the literature, IT was both an enabler and a constraint. Still, companies that seemed to be constrained by their IT infrastructure were often able upgrade it to overcome its deficiencies. In these process reengineering efforts, traditional information technologies such as telecommunication and databases were used more commonly than state-of-the-art technologies.

Rather than mere automation, information technology was more often used for monitoring processes and tasks, analyzing information and supporting decision making, or distributing and collecting information. However, the specific impacts of individual technologies on business processes were difficult to identify.

We also observed that, as companies reengineer, and thus adopt process management as their mode of operating, they also seem to be moving from bureaucratic functional hierarchies to more flexible, team-based organizations.

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1. INTRODUCTION

"Business process reengineering is spreading like a wildfire"; "It's new and it has to be done"; "It is an all-or-nothing proposition that produces dramatically impressive results" (Hammer & Champy 1993). These statements sound like good sales arguments. And in fact, that is exactly what they are.

In the mid 1980's, the business world saw the rise of a new phenomenon. Since it first occurred this phenomenon has been called by many different names. Some authors call it *business process reengineering* (BPR) or *process innovation*, others use terms such as *business process redesign*, *core process redesign*, or *business reengineering*. Despite this variety in terminology, all the authors basically refer to same concepts. Simply stated, *reengineering* means reorganizing those activities by which companies conduct their business to achieve radical performance improvements. By focusing on business processes rather than on functions or organizational units, companies aim at increasing the value-added to the customer and streamlining their operations at the same time.

Since these concepts were brought to the attention of wider audience in 1990, hundreds of companies have announced their business process reengineering programs and all major management consultancies have started to offer their services in this area. Furthermore, since the late 1980's, this subject has also been studied extensively by academics. Some of these studies, however, claim that even though many reengineering efforts have succeeded, most have failed (e.g. Bashein et al. 1994). Where some companies have achieved order of magnitude improvements, some have achieved either nothing or very little. Many companies seem to have ignored the fact that, *radical* changes in the ways people work or in the ways companies are organized seldom come easy. Nevertheless, even if fundamental organizational changes are associated with high risks, they also have the highest potential benefits. This is perhaps the greatest promise of reengineering.

Although hundreds of articles and a number of books have been written about reengineering, the 'theory' of reengineering is still at its infancy. Only recently, has some more profound work that aims at building such a theory been done (e.g. Kettinger & Grover 1995). The work so far has focused on, for example, criticizing the claimed novelty or sustainability of the whole concept (e.g. Grint 1993, Earl & Khan 1994, Strassmann 1993), some individual aspects of reengineering like the link between BPR and strategic planning (e.g. Teng et al. 1994a, Tinnilä 1995), or managing organizational change (e.g. Stoddard & Jarvenpaa 1994, Stoddard & Jarvenpaa 1995, Cooper & Markus 1995). Many authors have also proposed their own BPR methodologies (e.g. Davenport 1993, Johansson et al. 1993, Guha et el. 1993).

One central theme throughout the existing literature is that information technology (IT) is either the primary or at least very important enabler in redesigning business processes (e.g. Davenport & Short 1990, Hammer 1990, Davenport 1993, Hammer & Champy 1993). As Hammer and Champy (1993, p. 44) emphasize: "We say that in reengineering, information technology acts as an essential enabler". However, these proponents of reengineering may have overemphasized the role of IT as other studies show that IT is not always the driving force of change (Earl & Khan 1994, Stoddard & Jarvenpaa 1994, Earl et al. 1995).

In addition, there is actually very little research on the impact of information technology on business processes. This IT impact highlighted in BPR literature is often based on individual successful cases rather than on extensive empirical research. There is, of course, a large amount of previous research on the impact of information technology on work and organizations from many different perspectives and organizational settings. The difference now seems to be the process perspective taken. Because of the somewhat contradictory opinions and lack of empirical evidence, more research needs to be done in this area.

1.1 Objectives

The aim of this study is to further clarify the role of information technology in BPR. Because the subject under study is quite new and currently no well defined theory exists, the nature of this study is exploratory. We examine the use of information technology in reengineering projects in Finnish companies. More specifically, this study focuses on the following areas and research questions:

1. **Role of IT in BPR.** How important change lever is information technology in business process reengineering? Is information technology an enabler or a constraint of new process designs? Does the existing IT infrastructure meet the requirements of new systems or are major changes needed? Is the IT staff able to meet the challenges of the reengineering effort?

2. **Information technologies used in BPR.** What information technologies are used as change levers in Finnish BPR projects?

3. **Business process changes through IT.** What changes on business processes through information technology are realized if any? I.e., how specific information technologies are exploited in Finnish reengineering efforts?

1.2 METHODOLOGY

To meet our objectives, we first reviewed the existing literature to build a conceptual framework for the study. Based on the resulting framework, we then formulated the specific research questions for the empirical part of the study. Next, we carried out a two-phase mail survey during the first half of 1995. In the first phase, the overall situation of BPR in Finland was explored. Based upon the results from the first phase, we sent out the second phase questionnaire with the research questions concerning this study. Some data were also gathered by structured interviews based on the second phase questionnaire.

1.3 SCOPE AND LIMITATIONS

Information technology has mainly been used in two roles in BPR. First, it has been used as an enabler of changes in business processes. By this we understand the use of information technology to enable new ways of working and organizing work in business processes. Second, information technology has been used as a facilitator of implementation. This role refers to the use of IT, for example, as a modeling, simulation, or prototyping tool in various phases of a BPR effort. In this study the focus is on the enabling (or its opposite, disabling) role of information technology.

The selected research methodology imposes some limitations which may have reduced the amount of data received for the study. First, potentially good reengineering cases in smaller firms may have been missed because the target group for the first phase of the survey were large Finnish companies. Second, we asked specifically for efforts that were identified by the respondent as being BPR. Therefore, some projects which in closer look might have been identified as BPR, may have been omitted. This might have happened because either the concept itself was not recognized or similar activities were carried out under a different name, e.g. process improvement or total quality management (TQM). Additionally, because the target group for the first phase were managers responsible for information technology and for the second phase only project managers in specific reengineering efforts the data received may contain limited perspectives.

1.4 Outline of the Study

This paper is divided into five chapters. Chapter 1 is the introduction. In chapter 2, we first define business processes and business process reengineering, and then offer one possible perspective for reengineering as a vehicle for achieving new organizational forms. Chapter 3 focuses on reviewing existing literature on the impact of information technology on business processes and presents the framework of the study. In chapter 4, we first describe the research methodology in more detail and then present the results following the structure of the questionnaire. Chapter 5 has the summary and conclusions.

2. Business Process Reengineering

In this chapter, we introduce the main concepts of business process reengineering and also describe the relationships between BPR, organizational change, and information technology. As there is currently no 'good' theory on reengineering and the aim of this study is not to present one, the intention here is only to offer one possible perspective to reengineering as organizational transformation method and to build a general frame of reference for the rest of study based on these concepts. First, we begin by discussing the history and origins of reengineering. Then, we present the necessary definitions for business processes and business process reengineering. Next, the process of reengineering is described and other important aspects of reengineering are discussed. Finally, we discuss one alternative view on reengineering as a vehicle for organizational transformation.

2.1 The History and Origins of Reengineering

The development of the concept of *business process reengineering* is probably most attributable to a few seminal articles by Davenport and Short (1990) and Hammer (1990). Davenport and Short described in their article "The New Industrial Engineering: Information Technology and Business Process Redesign" how some American companies had successfully redesigned their business processes by using modern information technology. They described how this "new industrial engineering" could be accomplished by exploiting capabilities of information technology to achieve improvements in business processes. They also suggested a five step method for accomplishing this. Michael Hammer described in his 1990 article "Reengineering Work: Don't Automate, Obliterate", how Ford and Mutual Benefit Life had 'reengineered' their business processes to achieve order of magnitude improvements. He strongly urged other companies to do the same in order to survive in the 1990s. Hammer also presented his seven 'principles of reengineering' that would dramatically change the way companies did their business from there on. According to Hammer these principles should be applied to every American company by using "the power of modern information technology to radically redesign our business processes in order to achieve dramatic improvements in their performance."

These two articles presented perhaps the basic ideas behind reengineering but did it mostly by touting the concept as a new and completely different approach for companies to fight for survival in their turbulent business environments. These articles (and also the books later published by some of the authors) have sometimes been criticized by 'labelizing' the concept of reengineering with profit making objectives. However, the ideas and conclusions are based on empirical observations and as such should perhaps be considered as working hypotheses of the phenomenon called *business process reengineering*. During the past six years these hypotheses have more or less been tested by academics with the aim to validate business process reengineering as a separable concept and to build a theory on BPR.

Before we go further into examining the essence of reengineering, it is in place to shortly try to answer two basic questions: 1) Why is there a need for a concept such as reengineering and why do companies need to change, if they do?", and 2) Why would a company use business process reengineering instead of some other improvement method? The answers to these questions should shed some light on reasons why quite a few companies have jumped on the 'reengineering bandwagon'.

One possible answer to the first question is the need for companies to change in order to survive in today's turbulent business environment. Hammer and Champy (1993) state this need to reengineer quite bluntly: "The alternative is for corporate America to close its doors and go out of business". This statement, which may well be a good sales argument should, of course, be expressed in more concrete terms. Indeed, Grint (1993) and Talwar (1994) identify challenges such as *globalization of business*, *economic pressures from global recession*, *operational challenges such as the need for increased flexibility*, and *need for continued change to remain competitive* as the underlying needs for business process reengineering. Previously, companies have tried to solve these problems by using improvement methods such as total quality management (TQM), but the results may not have always been sufficient.

Now, when the 'need to do something' to save today's companies has been 'clearly' demonstrated, let us try to answer the second question: "Why should we use reengineering instead of some other improvement method?". The obvious answer would be, of course, that there is something new and better in BPR than in any of the previously tried improvement recipes. However, as Grint (1993) points out, some of the common practices of reengineering as presented by Hammer and Champy (1993) "are more novel than others but...none of them are actually innovations, least of all radical innovations". This would, of course, be in contradiction to our 'obvious' conclusion. Grint's critique, however, may lack some justification and generalizability as it is based mostly on Hammer and Champy's (1993) views. Their views are far from being the only ones presented, but may well be the best known. Even Thomas Davenport who is undoubtedly one of earliest proponents of business process redesign, has traced the roots of reengineering to

- quality movement (total quality management, TQM);
- industrial engineering and systems thinking;
- the work design approaches pioneered by the sociotechnical school;
- analysis of the diffusion of technological innovation;
- ideas about the competitive use of information technology. (Davenport 1993, p. 311)

Thus, at least not all the authors in BPR literature claim the novelty of reengineering. Indeed, even if none of the individual elements of reengineering were completely new, when these elements are taken and applied together they form a concept that has not been previously tried (e.g. Grint 1993, Davenport 1993, p. 311, Earl and Khan 1994). Nevertheless, the best argument for adopting reengineering may still be the promise of radical performance improvements highlighted by the successful case examples cited in popular reengineering literature.

2.2 BUSINESS PROCESSES

2.2.1 Definition of Business Processes

In order to fully understand business process reengineering it is clearly essential to have a sound understanding of the object of reengineering, the business process.

Because of the variety of academic backgrounds and other interests of the authors in BPR literature, number of different definitions for business processes exists. These definitions have distinctive similarities in their contents and they differ mostly on their terminology and formality. Tinnilä (1994) has analyzed the structure and elements of business processes found in previous definitions (Table 2-1). He concludes:

> ***Business processes*** *are logically related, structured and measured set of activities to produce a clearly defined output from an input to create added value to customer.*

According to Tinnilä (1994), the main characteristics of business processes based on the above definitions are:

1. They have customers, who use the output of the process;

2. They cross organizational boundaries (intra- and interorganisational);

3. Their efficiency should be assessed from customer viewpoint;

4. They have owners, who are responsible for the execution and performance of the process.

Author(s)	Definition
Pall (1987)	Business process is the logical organization of people, materials, energy, equipment, and procedures into work activities designed to produce a specified end result (work product).
Davenport and Short (1990)	Business process is a set of logically related tasks performed to achieve a defined business outcome.
Davenport (1993)	Business process is a specific ordering of work activities across time and place, it has a beginning, an end, and clearly identified inputs and outputs.
Davenport (1993)	Process is a structured, measured set of activities designed to produce a specified output for a particular customer or market; a structure for action.
Hammer (1993)	Activities that take one or more kinds of input and create an output that is of value to the customer.
Johansson et al. (1993)	A process is a set of linked activities that take an input and transform it to create an output. It should add value to the input and create an output that is more useful and effective to the recipient.
Scherr (1993)	BP is a series of customer-supplier relationships that produces specific results at specific points in time.

Table 2-1. Definitions of business processes (Tinnilä 1994).

The definition of business processes by Tinnilä (1994) is adopted for this study as it seems to be the most comprehensive.

2.2.2 Classifications of Business Processes

Similarly, as there are many different definitions of business processes, there are also different classifications for them. The aim of any classification for business processes should be to serve as a tool that gives guidance on how to approach the redesign effort. Different classifications could then be used for different purposes, for example, strategic planning, or to point out different implementation paths.

Davenport and Short (1990) have proposed a multidimensional classification for processes (Table 2-2). This classification, however, is of limited use in the actual redesign effort. Although it captures certain important characteristics of business processes, the identification of these characteristics leads to no real implications for the design of a new process or even to different management approaches. This is because the characteristics can all very often be found in one particular process.

For example, Ford's procurement process (Hammer & Champy, 1993, pp. 39-44) has most of these elements. Because the process involves suppliers it falls into the category of *interorganisational* processes. It is also an *interfunctional* process because it involves the three functions, inventories, purchase department and accounts payable. When different people perform the tasks within the process they normally interact so it may also be considered an *interpersonal* process. The objects in the process are *both physical and informational.* The goods delivered represent the former and the purchase order represents the latter. However, the different activities in the process are mostly *operational* and this may perhaps be the only clear distinction in this exemplary case.

Process Dimension and Type	Typical Example	Typical IT Role
Entities		
Interorganisational	Order from a supplier	Lower transaction costs; eliminate intermediaries
Interfunctional	Develop a new product	Work across geography; greater simultaneity
Interpersonal	Approve a bank loan	Role and task integration
Objects		
Physical	Manufacture a product	Increased outcome flexibility; process control
Informational	Create a proposal	Routinizing complex decisions
Activities		
Operational	Fill a customer order	Reduce time and costs; increase output quality
Managerial	Develop a budget	Improve analysis; increase participation

Table 2-2. Types of Processes (Davenport & Short 1990)

Earl and Khan (1994) have classified processes according to their value chain focus and structuredness. Their typology (see Figure 2-1) includes:

- *core processes*, which are the primary vehicles for delivering added value to customers;
- *support processes*, which cover the secondary activities of a company;
- *management processes*, by which companies plan, organize and control their resources; and
- *business network processes* are processes in the extended business network and they involve customers, suppliers and other partners.

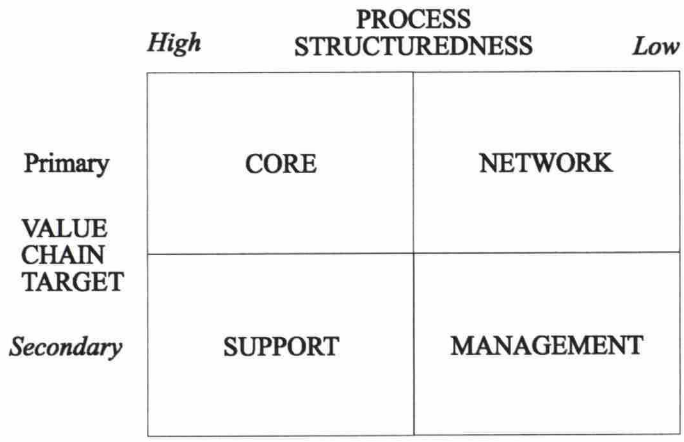

Figure 2-1. Typology of Processes (Earl & Khan 1994).

This typology is easy to relate to and might prove useful in identifying processes and in choosing different strategic reengineering approaches. However, the definitions for core processes and business network process are quite similar and the distinction between them is not always so clear.

For strategic planning purposes, perhaps the most useful classification of business processes is proposed by Edwards and Peppard (1994). They differentiate business processes according two important themes found in literature of business strategy: *competitive advantage* within an industry and *core competencies* of a company.

Edwards and Peppard suggest that business processes can be classified to *core processes, underpinning processes, competitive processes and infrastructure processes* (Figure 2-2). Core processes include all processes needed for the company to operate on a market, but they are all not necessarily chosen as basis of competition. Competitive processes, on the other hand, are core processes that directly support the company's product and market strategy. Underpinning processes are similar to Earl and Khan's (1994) support processes with no direct value chain focus. Infrastructure processes are those which have an effect on the long term competitiveness of the company by providing the critical core competencies for future. In addition, Edwards and Peppard propose that when time elapses business processes have a tendency to migrate from one class to another because of 1) changes in the business strategy of the company, 2) competitors' actions, and 3) environmental factors.

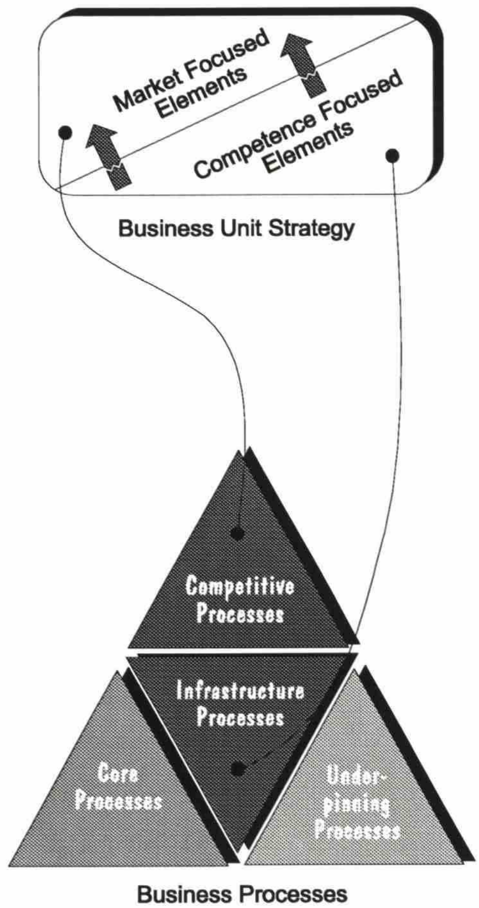

Figure 2-2. Linking Business Unit Strategy to Business Processes (Edwards & Peppard 1994).

Yet another typology would obviously be possible. Most companies have, for example, some kind of *product development process* and *order fulfillment* process (or *order management)* which are not necessarily company specific in their characteristics but may even be rather generic. Therefore, they can be considered as generic process types rather than examples of processes, although they have not been presented as such.

All these slightly different, yet sometimes overlapping classifications serve some valuable purpose. They can be used either for identification of a firm's processes, determining the process scope and focus, strategic planning, or prioritization and selection for target processes. They are also likely to be used in different phases of the reengineering effort.

2.3 BUSINESS PROCESS REENGINEERING (BPR)

2.3.1 Definition of Business Process Reengineering

Currently, there is no generally accepted definition for business process reengineering. A number of different and competing definitions exist. Davenport and Short (1990) and Hammer (1990) have probably provided the first definitions of business process reengineering:

> *We should* ***reengineer*** *our businesses: use the power of modern information technology to radically redesign our business processes in order to achieve dramatic improvements in their performance (Hammer 1990).*

> ***Business process redesign*** *- the analysis and design of work flows and processes within and between organizations (Davenport and Short 1990).*

A number of definitions have been introduced since the advent of these two definitions (Table 2-3). The essence of different definitions is much the same, but the terms used and the formality of definitions vary. Many different terms for the phenomenon itself has been used. These include *business process reengineering, business process redesign, business reengineering, core process redesign,* and *process innovation* (see Table 2-3 for sources). In this study, these terms are used interchangeably.

Author	Term	Definition
Hammer and Champy (1993)	BP Re-engineering	The fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, service and speed.
Davenport and Short (1990	BP Redesign	The analysis and design of work flows and processes within and between organizations.
Davenport (1993)	BP Innovation	One-time process innovation effort to achieve radical business improvement.
Morrow and Hazell (1992)	BP Redesign	BP redesign is the examination of the flow of activities and information that make up the key business processes in an organization with a view to simplification, cost reduction or improvement in quality or flexibility.
Short and Venkatraman (1992)		The company's actions to restructure internal operations to improve product distribution and delivery performance to the customer.
Loewenthal (1994)	Organizational reengineering	The fundamental rethinking and redesign of operating processes and organizational structure, focused on the organization's core competencies, to achieve dramatic improvements in organizational performance.
Willoch (1994)	BP re-engineering	Radical redesign of business processes to achieve dramatic performance improvements
Johansson et al. (1993)	BP re-engineering	BPR is the means by which an organization can achieve radical change in performance as measured by cost, cycle time, service, and quality, by the application of a variety of tools and techniques that focus on the business as a set of related customer-oriented core business processes rather than a set of organizational functions.

Table 2-3. Definitions of business process redesign and reengineering (adapted from Tinnilä 1994).

Tinnilä (1994) has analyzed the above definitions and formulated a synthesis: "Business process redesign is the fundamental, one-time rethinking, innovation and radical redesign and analysis of critical, key business processes within and between organizations to achieve dramatic improvements in performance measured by several measures". This synthesis probably captures all the characteristics found in earlier definitions but for the purposes of this study it is too narrow. A broader perspective to reengineering is needed. The reason for this is that, as for example Davenport (1995) has pointed out, "reengineering means different things to different people." Consequently, as will be discussed in more detail later, there are many different approaches to changing business processes. Therefore, the definition of reengineering by Davenport and Short (1990), which allows more variance, is used in this study.

A definition of reengineering, even a comprehensive one, cannot fully and exhaustively describe this complex issue. It is therefore necessary to shortly describe some of the important aspects of reengineering. Next, we try to further clarify the phenomenon by first outlining the actual process of reengineering and then by discussing the risks and benefits of reengineering.

2.3.2 Benefits, Risks, and the Process of Reengineering

Process of reengineering.

Reengineering itself is a process with many activities. As such, it requires a methodological approach in order to be successful and to gain the desired results. Typically, reengineering projects have two major phases with number of intermediate steps. Salo (1995) has summarized the methodologies found in the literature to the following decomposition of reengineering as a change process (Table 2-4). This decomposition outlines the different steps found in both of the two major phases and lists the activities found in each step. It resembles the cascade and life cycle models used in, e.g. information systems development projects. This is only natural as these issues are closely related.

For the scope of this study, the stages two and four are the most relevant. During these stages the role of information technology in the reengineering effort should be considered. In stage two, the activities of identifying problems, enablers and opportunities include the consideration of possible enabling information technologies (e.g. Davenport & Short 1990, Davenport 1993, p. 25). In stage four, the selected technologies can be further operationalized, for example, by considering the specific applications to be developed.

PHASE I	PHASE II
1. Initiative and Identification	**5. Prototyping and Refining**
• acknowledge reasons for reengineering	• prototype redesigned process
• identify processes and their boundaries	• evaluate against objectives
2. Prioritization and Visioning	• make necessary adjustments
• evaluate and select candidate processes	**6. Preparation for Implementation**
• identify problems, enablers and opportunities	• communicate necessity and create climate
	• align organization to new process
• set broad objectives and attributes	• readjust control and management systems
• organize reengineering team	• create appropriate infrastructure
3. Analysis and Measurement	**7. Piloting and Assessment**
• analyze and model existing processes	• execute pilot project
• evaluate feasibility against objectives	• evaluate against objectives and attributes
• assess economic viability	• adjust process design and implementation plan
• measure current performance	**8. Full Scale Implementation and Optimization**
4. Redesign and Planning	• implement adjusted target process
• design detailed target process	• link to continuous improvement plans
• develop implementation plan	

Table 2-4. Phases and Stages of Reengineering
(adapted from Salo 1995, numbering of stages added by author).

Benefits of reengineering.

When reengineering projects succeed they typically result in substantial economic benefits for the organization. In other words, the underlying assumption in reengineering is that radical changes lead to radical improvements and therefore also to substantial economic benefits. By substantial, the reengineering authors typically mean order of magnitude improvements, e.g. 50 % reduction in costs, tenfold decreases in cycle times, or manifold increases in productivity. Other operational improvements include, for example, increases in output quality and customer satisfaction (e.g. Davenport & Short 1990). Naturally, these benefits are also typical objectives for reengineering efforts. In addition, more strategic objectives have been proposed. An example of the strategic objectives might be something what Venkatraman (1994) considers the redefinition of a firm's business scope.

Risks in reengineering

Radical organizational changes involve also great risks. Clemons (1995) concludes that the biggest risks in reengineering are: 1) *functionality risk* - the risk of making the wrong or insufficient changes, and 2) *political risk* - the risk of not being able to complete the effort because of organizational resistance to change. The political risk is more severe and may be more easily realized as managing the social aspects in reengineering is extremely difficult and consequently also more critical to success (Grover et al. 1995, Stoddard & Jarvenpaa 1995). For the scope of this study, however, the functionality risk is of more importance as it involves issues such as lack of expertise in IT in the organization, failure to aggressively use IT enablers, etc. (for a more complete discussion on these "technological competence problems" see Grover et al. 1995).

2.4 ORGANIZATIONAL CHANGE THROUGH BPR

It has been proposed that business process reengineering is a vehicle for organizational transformation (Short & Venkatraman 1992, Davidson 1993, Venkatraman 1994). In fact, in many reengineering cases, changes in organizational structures, skills and roles of employees, organizational values, and management and measurement systems have been observed (e.g. Hammer & Champy 1993, pp. 65-82). This approach for examining reengineering as organizational change is also adopted for this study. However, Davenport and Stoddard (1994) point out that reengineering *is* not synonymous with *organizational transformation.* Reengineering is a process where organizational business processes are redesigned and which may result in organizational transformation depending on how profound the changes in processes are (Davenport and Stoddard 1994).

2.4.1 Change Outcomes and Strategies

Venkatraman (1994) has identified five different levels of business transformation through information technology and proposed a framework for analyzing these (Figure 2-3).

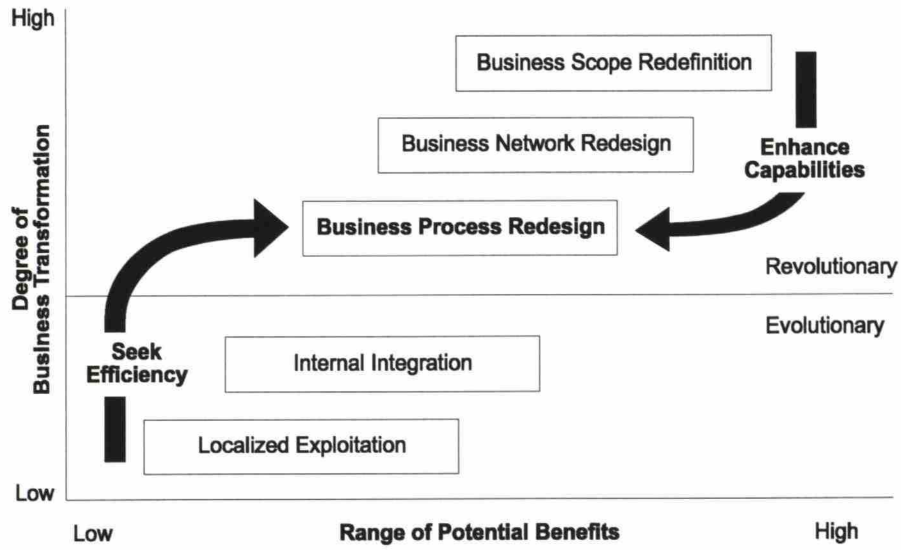

Figure 2-3. Alternative Approaches to Business Process Redesign (Venkatraman 1994).

In this framework, the degree of IT-enabled business transformation is distinguished in five separable levels depending on the scope of the intended change. The degree of business change is seen to vary from *localized exploitation* of IT, often within one specific function, to a *redefinition of the business scope* of the firm. According to the model, the potential benefits increase as the level of business transformation increases. In addition, the two lower levels of transformation (localized exploitation and internal integration) are considered evolutionary. The latter three (business process redesign, business network redesign, and business scope redefinition) are considered revolutionary with more radical scope and objectives for the organizational change. Where the objective of the evolutionary approach is primarily to seek efficiency gains with current strategy, the objective of the revolutionary approach is to enhance the capabilities of the company. (Venkatraman 1994)

Although the above framework seems appealing, its application into practice may be problematic. First, although the above framework identifies different levels of business transformation and describes their distinctive characteristics, in reality, these differences, especially on the middle levels, may be difficult to identify. Second, the different definitions and descriptions offered on reengineering do not quite match the above levels (see Table 2-1, p. 9). For example, Kaplan and Murdoch (1991) state that "core processes" (their term for a business process) may include activities of suppliers and customers. In the above framework, however, a distinction is made between those processes that cut across only intraorganisational boundaries and those which reach outside the focal organization. Still, as noted earlier, most of the authors use terms like 'business process redesign' or 'core process redesign', refer to basically the same set of activities (e.g. Kaplan & Murdoch 1991, Hammer 1990, Davenport & Short 1990, Davenport 1993).

Additionally, business processes can be, and very often are, decomposed to subprocesses that may cross only very few functions. When these subprocesses are reengineered substantial improvements may be achieved *through radical changes within the scope of the process.* According to several definitions and examples of reengineering cases (e.g. Davenport & Short 1990, Davenport 1993, Hammer & Champy 1993) this would be identified as business process reengineering. It would not, however, well fit in the description of the third level in the above framework. Therefore, we should point out that, although conceptually different levels of business transformation may exist, in reality, these boundaries may be difficult to identify.

Venkatraman (1994) also argues that so far the majority of reengineering efforts have typically been examples of business process redesign (level three in the above framework). Recently, however, some examples of business network reengineering have been identified. Kambil and Short (1994) have studied the effects of *electronic integration* -" the use of information technology to reengineer key business processes and business relations" - in the US tax preparation market. They use a roles-linkage model to identify changes in the value-added activities (roles) of different players and the different types of exchange relationships (linkages) between them in the business network. Kambil and Short (1994) conclude that electronic integration leads to new organizational forms and new value-added activities in a business network. In addition, new types of linkages emerge to integrate the new roles into the business network.

Scope and Depth of Process Change

The degree of business process change can be examined on two dimensions: the scope of change and the planned depth of change (Figure 2-4).

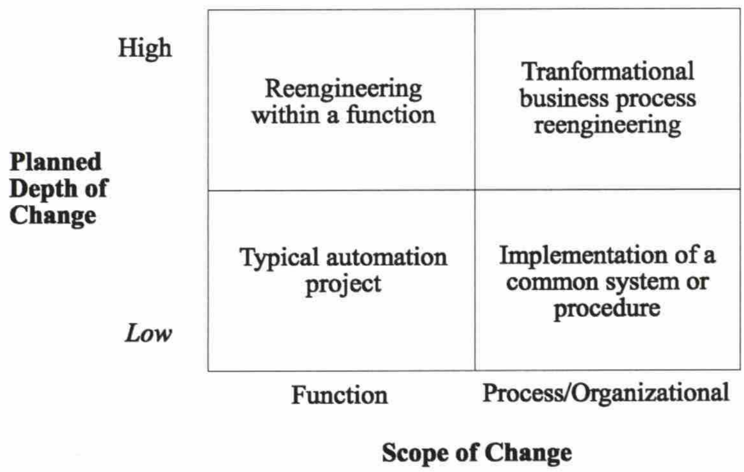

Figure 2-4. Types of IT-Enabled BPR Change Outcomes (Stoddard & Jarvenpaa 1994).

The scope of change is measured by the organizational reach of the reengineered business process. The scope of the process can range from one function to several functions or to the whole organization or it can cut across interorganisational boundaries. The planned depth of change is measured in changes in key elements of the organization that are affected by reengineering. These elements include technology, jobs, skills, structures, shared values and measurement systems.

Different levels of business transformation through information technology (=reengineering) are likely to require different amount of management attention and also different tactics for managing the intended change (Jarvenpaa & Stoddard 1995). The change tactics used depend on the level organizational of changes and the phase of the project. *Revolutionary tactics*, such as acquiring leadership for the effort from outside the company, are used to achieve radical changes and often in the early phases of the project. *Evolutionary tactics*, like relying on current managers and employees to carry out the project, are typically used to achieve incremental improvements in a longer period of time. Evolutionary tactics are also most likely to appear on the implementation phase of the reengineering effort. (Stoddard & Jarvenpaa 1995)

Reengineering Strategies

Because there is a great variance in degree of process changes between different reengineering efforts, it is also likely that different strategies for reengineering are needed. This has been observed by Earl et al. (1995) who suggest that four polar types of BPR strategies are emerging: *engineering* strategy, *systems* strategy, *bureaucratic* strategy, and *ecological*. These archetypal strategies differ in four perspectives: *process, strategy, information systems,* and *change management and control* strategy (see Table 2-5).

All these strategies have distinct characteristics. For example, the reengineering efforts using the *engineering strategy* are typically initiated by identification of an operational problem. Line managers lead these efforts and the dominant IS contribution is on process integration and IS expertise needed is typically systems design. The reengineered process is benchmarked against best performers and operational efficiency is the primary objective. The focus here is on operational activities with the objective of workflow optimization which is achieved by redesigning work roles, activities, and workflows. On the other hand, the reengineering projects where the *bureaucratic strategy* is employed, seem to emerge from formal strategic planning processes. Therefore, these efforts are typically led by SBU management. The focus is on core capabilities in primary value-chain processes to achieve competitive advantage. The process attributes primarily addressed are value chains and workflows. The IS function contributes on process construction and by increasing BPR awareness among managers (Earl et al. 1995).

As can be seen from the table, there are significant differences in the scope of the reengineering efforts and the approaches taken. However, as these observations are based on preliminary findings, the authors do not propose any contingencies for the appearance of different strategies. In addition, there seems to be variances in the enabling role of IT between different BPR efforts and within each strategy adopted (Earl et al. 1995). This observation is supported by findings of Earl and Khan (1994) and Jarvenpaa and Stoddard (1994). Information technology seems to play more important role when either *engineering* or *systems* strategies are adopted, but may be less significant when either *bureaucratic* or *ecological* approaches to reengineering are used (Earl et al. 1995).

BPR Strategies	Ecological	Bureaucratic	Systems	Engineering
Process perspective				
Process paradigm	Process as a management design	Process as a core capability	Process as systems opportunity	Process as workflow optimization
Process attributes	Decision responsibilities and decision flows	Value chains and workflows	Information systems opportunities and information workflows	Work roles and workflows
Strategy perspective				
Strategic motive	Dynamic adaptation	Resource capability	Information leverage	Benchmarking and efficiency
Strategic scope	Enterprise	SBU	Cross-functional information-intensive activities	Cross-functional operations-intensive activities
IS perspective				
Dominant IS contribution	Process consciousness	Process construction	Process coordination	Process integration
IS expertise	Systems modeling	Systems awareness	Systems analysis	Systems design
Change management perspective				
Change initiation	Vision	Strategic planning	IS planning	Process owner
Change sponsor	CEO	SBU management team	Process owner	Line management

Table 2-5. BPR Strategies (Earl et al. 1995).

Depending on the approach taken, and the degree and nature of changes implemented, reengineering business processes may result in new organizational forms. The next section discusses some of these new emerging organizations and their characteristics.

2.4.2 BPR and the New Organization

The logical question that emerges is what does the organization look like after its processes have been reengineered? One, but perhaps only partial answer to this question is that, reengineering together with use of information technology results in new organizational forms (e.g. Kambil & Short 1994, Lucas & Baroudi 1994, Nolan 1995). The underlying assumption of this proposition is that organizational changes are implemented by reengineering organizational business processes.

However, it is not easy to describe the 'new organization' because it may not be even quite clear what is the 'old organization'. The reason for this that a variety of different perspectives to organizations exists.

The most common view of organizations, although numerous other approaches and metaphors exist, is perhaps the 'mechanistic' view. It originates from the classical management theory pioneered by e.g. Adam Smith, Max Weber, Henri Fayol and Frederick Taylor (Morgan 1986, pp. 19-38). The results of their work, in the form of the principles of classical management theory, is summarized in Table 2-6.

When applied, many of these principles have resulted in bureaucratic organizations with multiple levels of management hierarchies and high degree of division of labor through narrowly defined tasks. The application of these principles of organizing have also brought in problems of coordination, and suboptimization when functional units have conflicting objectives.

By reengineering their business processes companies should break away from these outdated modes of organizing (Hammer & Champy 1993, pp. 11-17). For example, Davenport and Nohria (1994) have observed that one recurring theme for organizing work in reengineering efforts is the *case management* approach. This mode of organizing, effectively breaks the rule of functional division of labor as it combines several previously separate jobs into one. A case manager or a case management team completes a closed loop work process to serve a customer. They are located at functional intersections and have the authority to make decisions concerning customer issues. In order to do this, they must have easy access to information from several sources (e.g. pricing, production and logistics databases) around the organization. Evidently, in order to be operational the case management approach requires changes in other key elements of the organization, such as skills needed to perform the work as well as reward and monitoring systems. Similarly, as in this example, many other of the classical principles for organizational design are often violated in new organizational forms (Lucas & Baroudi 1994).

Principle: Description
Unity of command: an employee should receive orders from only one superior
Scalar chain: the line of authority from superior to subordinate, which runs from top to bottom of the organization; this chain, which results from the unity-of-command principle, should be used as a channel for communication and decision making
Span of control: the number of people reporting to one superior must not be so large that it creates problems of communication and coordination
Staff and line: staff personnel can provide valuable advisory services, but must be careful not to violate line authority
Initiative: to be encouraged at all levels of the organization
Division of work: management should aim to achieve a degree of specialization designed to achieve the goal of the organization in an efficient manner
Authority and responsibility: attention should be paid to the right to give orders and to exact obedience; an appropriate balance between authority and responsibility should be achieved. It is meaningless to make someone responsible for work if they are not given appropriate authority to execute that responsibility
Centralization (of authority): always present in some degree, this must vary to optimize the use of faculties of personnel
Discipline: obedience, application, energy, behavior, and outward marks of respect in accordance with agreed rules and customs
Subordination of individual interest to general interest: through firmness, example, fair agreements, and constant supervision
Equity: based on kindness and justice, to encourage personnel in their duties; and fair remuneration which encourages morale yet does not lead to overpayment
Stability of tenure personnel: to facilitate the development of abilities
Esprit de corps: to facilitate harmony as a basis of strength

Table 2-6. Principles of classical management theory (Morgan 1986, p. 26)

2.4.2.1 Characteristics of the New Organization

Lambert and Peppard (1993) have made an effort to characterize the "new organization". In their opinion the 21st century organization constantly challenges the traditional organizational assumptions (for these see Table 2-6 above). The managers of these new organizations should have a clear vision of what is the required organizational form and this vision should also extend to the industry level. The new organization is process driven with focus on customer satisfaction. The main building blocks of the business processes are "multi-disciplinary self-managing teams with mutual role acknowledgment." These teams help in generating achievement culture and therefore the reward structures must also be based on team performance. Team structures together with IT-enabled business processes result in increased flexibility, fast responsiveness and reduced cycle times. In the new organization, information is considered as an important asset and learning takes place at all levels of the organization. The above characteristics are based on six different perspectives to new ways of organizing identified from the literature (Lambert & Peppard 1993):

Network organization focuses on those value-added activities in a business network it does best. Options such as outsourcing, value adding partnerships, strategic alliances and business network redesign are used to cope with increasing competitive pressures and demand for efficiency and effectiveness. Information technology typically facilitates communication and coordination between the networked organizations.

Task focused teams where people with complementary skills work towards common goals are used in many organizations. By organizing around teams, coordination between tasks and higher performance are achieved. Information technology enables, for example, geographically groups to coordinate their activities through electronic communication.

Networked groups are recognized, social structures within an organization where external and internal information, experiences, views, and problems are shared among managers from different functions and levels of the organization. They differ from teams as they are not designed to solve predefined problems, but are more ad-hoc and dynamic by nature. They allow managers to run a big company like a small one by bringing in different business skills and functional expertise from all around the company.

In *horizontal organizations* work is organized around business processes rather than around functions. The concepts and methods of business process redesign are applied to build these organizations and to achieve flexibility and responsiveness.

Learning organizations are characterized by their commitment to knowledge creation, mechanism for incorporating this knowledge in processes and procedures, and responsiveness to external environment. Information technologies such as groupware used for knowledge sharing can facilitate these activities.

Matrix management in this context does not refer only to the structure of the organization, but more to a mindset of multidimensional and cross-functional information flows, relationships and systems. The focus of the matrix management should be on developing employees abilities in coping with complex structures that are needed for implementing sophisticated strategies.

2.4.2.2 New organizational forms

Some of the above characteristics or themes of organizing can be found in the four emerging prototypical organizations that have been by identified Lucas and Baroudi (1994). In some of these organizations information technology is used to substitute some traditional organizational elements and therefore IT is an essential part of the new organizational form. In others, IT is used only as enhancement and extension to traditional organizational design variables. (Lucas & Baroudi 1994)

These four types of organizations are presented next with examples of the "IT design variables". Because of the limited scope of the study, the new IT design variables suggested by Lucas and Baroudi (1994) are not discussed here in detail, but are presented when appropriate in each of the examples below.

Virtual organizations challenge the traditional assumption of the need for physical organizations. In these organizations, employees do not work in traditional offices but may work for example at home. Communication technologies like electronic mail and video conferencing are the primary means of both external and internal communications. Electronic workflows are crucial for operations and they also provide the means for monitoring work and performance (Lucas & Baroudi 1994). These organizations perhaps best fit the description of an organization that Jarvenpaa and Ives (1994) call "the global network organization of the future". They describe the successful organization of tomorrow as being "designed around the building blocks of advanced computer and communications technology." Organization's success is dependent on its "ability to couple and decouple from the networks of knowledge nodes." What Jarvenpaa and Ives (1994) describe in their scenario is a non-structured organization where specialists, together with outside partners, form ad-hoc teams to work on and solve one-time customer problems.

Negotiated organizations can perhaps best be described as brokers that take extensive use of outsourcing. They base their operations on negotiated agreements with other companies that provide for example the production facilities and/or logistics services. These arrangements often require electronic links between the organizations to achieve timely information flows and coordination. An example of this kind of organization is the Californian flower company, Calyx and Carolla, that uses Federal Express to provide overnight deliveries and use agreements with number of flower growers that produce the products (Lucas and Baroudi 1994).

Traditional organizations use typically information technology to make changes in some parts of the organizations. Virtual modes of operating can be achieved for example by JIT delivery of materials when the inventory of the producer is "virtually" absorbed by the supplier. These arrangements typically require electronic links such as electronic data interchange. Process redesign is also considered by the authors as an attempt for a traditional organization to exploit IT design variables to substitute for traditional modes of organizing. Electronic workflows increase the efficiency of processes in traditional organizations by replacing paper and reducing cycle times (Lucas & Baroudi 1994).

Vertically integrated conglomerates use electronic links and interorganisational systems for tight integration with suppliers' and customers' operations. These external companies virtually become components of the conglomerate as in case of General Motors and its suppliers. Information technology is used to achieve high level of coordination in activities (Lucas and Baroudi 1994).

Of course, other issues such as people and tasks, which add more organizational design variables should also be considered when designing organizations (Lucas & Baroudi 1994). However, because of the limited scope of the study these variables are not discussed here.

As noted earlier, Lucas and Baroudi (1994) also suggest that reengineering may be best viewed as an attempt for an traditional organization to exploit the new IT design variables. They also point out that completely new organizations are more likely to adopt the form of a virtual organization. However, we might actually consider reengineering as an attempt for any organization to move from the current form to some other, more advanced and flexible, mode of operating. If the exploitation of the IT design variables is extensive enough, a traditional organization might even become a virtual one. This kind of transformation is more likely to happen with smaller organizations. Indeed, the radical changes required would perhaps be impossible to implement in a "vertically integrated conglomerate" such as General Motors. It is also more likely that the appearance of the above prototypical organizations vary between industries. For example, in manufacturing intensive industries, like the automobile industry, the "traditional" and "vertically integrated conglomerate" seem perhaps more natural design strategies. At the other end, "virtual organizations" and "negotiated organizations" may emerge more easily in industries where information and knowledge are the products (e.g. consultancy, financial services) and physical facilities may not be necessary at all.

To summarize, reengineering should perhaps be considered as a business process focused, organizational transformation effort. These efforts vary in the degree of organizational changes implemented. The degree of organizational change is measured by the scope and depth of the business processes being reengineered. The result of reengineering may be either partially or completely new organizational forms. The primary driver of change is information technology. In the next chapter, the impacts of information technology on business processes are discussed in more detail.

3. INFORMATION TECHNOLOGY IN BPR

In the previous chapter we presented reengineering of business processes as one possible method to achieve new organizational forms. In this chapter the primary focus is on describing how information technology is used to enable the necessary changes in processes which eventually may lead to these new organizational forms. We first shortly discuss on the importance of IT in reengineering in general. Next, we present the two different roles that information technology has in BPR. Then, we review the previous work in the area to describe in more detail how IT can be used to change processes. Finally, we discuss how IT can prohibit making changes in processes and then we summarize with the framework for the empirical part of the study.

3.1 WHY IS INFORMATION TECHNOLOGY IMPORTANT?

The proposition of information technology's important role in process reengineering perhaps stems from some of the late 1980s research findings, which suggested that despite individual cases there is no evidence of the increased overall productivity and profitability of businesses from heavy investments in information technologies. This lack of identifiable return on IT investments has been known as "the productivity paradox" (e.g. Brynjolfsson 1993). However, Brynjolfsson and Hitt (1994) argue that the accuracy of some earlier research findings may be questioned due to number of reasons, e.g. measurement problems and too narrow time frame. They conclude that a link between productivity and IT investments actually does exist, but that this issue should be examined from three different perspectives (productivity, business performance, and customer value) which each are measured with different methods and therefore lead to slightly different answers.

However, according to Davenport (1993, p. 45), information technology and productivity are related but economic benefits from IT investments result only when information technology initiatives are combined with appropriate business process changes. Supporting observations have earlier been made by Benjamin et al. (1990) in their studies of the impact of electronic data interchange (EDI) systems on customer-supplier relationships. They conclude that "the most overlooked factor in determining the effective use of EDI is the organization's ability to manage the changes in structure and work process that must attend the implementation of this technology."

One might also argue that the importance of IT in business process redesign has been overemphasized. At least it has been very efficiently marketed due to IT consulting background of the early advocates of the concept (Davenport 1995). In fact, Earl and Khan (1994) have pointed out that even very simple information systems have been used to reengineer processes. Some companies have also been able to achieve substantial improvements on process performance even without fully operational information systems (Jarvenpaa & Stoddard 1994). Moreover, the preliminary findings of Earl et al. (1995) suggest that there are variances in the enabling role of IT between different BPR projects. All these observations seem to support Davenport's (1993, p. 17) observation that other drivers for radical change, such as information, organization, and people are required in conjunction with IT in successful reengineering.

3.2 DIFFERENT ROLES OF IT IN BPR

Information technology is used primarily in two different roles in business process reengineering (Figure 3-1). It is used as an enabler and implementer. The enabling role can basically refer to two opposite sides of the same coin - the opportunities and the constraints.

Typically, we are able to use information technology to reorganize business processes in a way that was previously either economically infeasible or even impossible. Sometimes, however, information technology can limit the choices a firm has in constructing new business processes because some existing technologies and systems might not be easily abandoned (e.g. Davenport and Short 1990, Davenport 1993, pp. 199-217, Earl & Khan 1994, Jarvenpaa & Stoddard 1994)

Information technology is, of course, a valuable tool which facilitates designing new business processes. For example, new process designs can be modeled by using traditional software design tools or tools designed especially for process modeling. Furthermore, simulation systems can be used to facilitate the evaluation of different process designs. The development cycles of new information systems needed for new business processes can also sometimes be shortened by using CASE tools. (e.g. Davenport 1993, pp. 199-217, Dennis et al. 1993, Douglas 1993, Hansen 1994, Klein 1994)

In the next sections, we first look at the enabling role of information technology in more detail and then discuss about the constraining role of IT. The two remaining roles are outside the scope of this study.

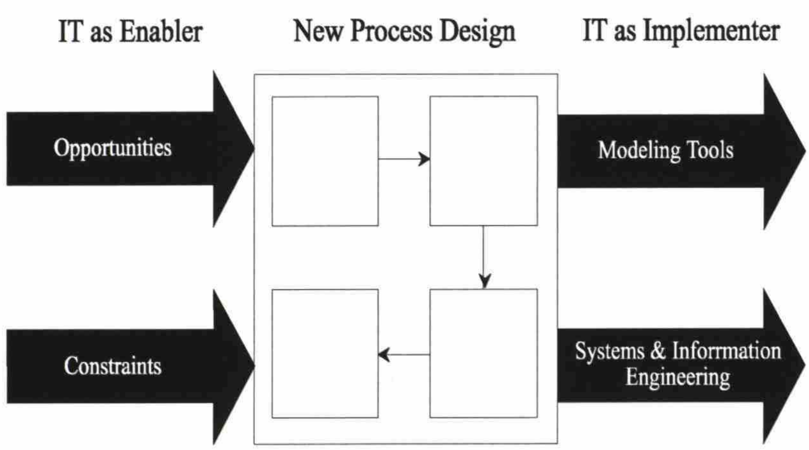

Figure 3-1. The Role of IT in Process Innovation (Davenport 1993, p. 49).

3.3 Information Technology as an Enabler of Process Change

In BPR literature, the term information technology (IT), is often used as an umbrella term covering all kinds of information technologies and systems. These include computers, telecommunications and networks, wireless phones, video conferencing systems, decision support systems, and many others. This broad view on IT is also adopted for this study.

Despite the fact that, information technology is typically considered as the primary enabler of new process designs (Davenport & Short 1990, Hammer 1990, Hammer & Champy 1993, p. 44, Davenport 1993, p. 17), there is actually very little empirical research on or even theoretical work concerning the enabling role of information technology in business process reengineering. Majority of the literature in the BPR area seems to accept the proposition of enabling role of IT offered by, e.g. Davenport and Short (1990) without much reservation. However, we should note that the impact of information systems and technologies on individual's work, organizations, and industries has been of much interest for academics and therefore a large amount of research on this area already exists. What seems to be different now is the business process perspective. The next sections review the different approaches presented in the BPR literature which describe the change effect of information technology on business processes.

IT Capabilities and Process Opportunities

Information technology is typically considered to have certain unique *capabilities* that offer new opportunities for designing business process and organizing work. Therefore, these capabilities should be exploited and all relevant opportunities should be considered when new processes are designed (Davenport & Short 1990, Davenport 1993, pp. 51-55, Earl & Khan 1994). The IT capabilities and their corresponding process opportunities describe either the observed process changes, or how technology is used. These capabilities are generic in nature and do not necessarily result from any specific technology.

Davenport and Short (1990) argue that the impact of information technologies on organizations is generally to "improve coordination and information access across organizational units to achieve more effective management of task interdependence". However, they continue that *in process context* it is more useful to consider some specific capabilities of information technology and its organizational impacts (Table 3-1). They also point out that their of capabilities is not exhaustive but other capabilities that are company or process specific might also be possible.

Capability	Organizational Impact/Benefit
Transactional	IT can transform unstructured processes into routinized transactions
Geographical	IT can transfer information with rapidity and ease across large distances, making processes independent of geography
Automational	IT can replace or reduce human labor in a process
Analytical	IT can bring complex analytical methods to bear on a process
Informational	IT can bring vast amounts of detailed information into a process
Sequential	IT can enable changes in the sequence of tasks in a process, often allowing multiple tasks to be worked on simultaneously
Knowledge Management	IT allows the capture and dissemination of knowledge and expertise to improve the process
Tracking	IT allows the detailed tracking of task status, inputs, and outputs
Disintermediation	IT can be used to connect two parties within a process that would otherwise communicate through an intermediary (internal or external)

Table 3-1. IT capabilities and Their Organizational Impacts (Davenport & Short 1990).

These IT capabilities are further refined by Davenport (1993). He also considers them as being “opportunities for process innovation”, although he basically describes the same impacts. Davenport (1993) also points out that all these categories of change opportunities “reflect the specific means by which these business objectives are achieved”. By business objectives he means cost reduction, cycle time reduction, quality improvements etc., all of which are common objectives of reengineering.

Comparison of the two lists (Davenport and Short 1990, Davenport 1993) reveals that most of the items have remained the same but, some have changed either by name, or in meaning, or both. *Knowledge management* has been changed to *intellectual* impact and the reference to improvements in the process has been left out perhaps because all of these impacts can be, in a broad sense, considered to improve the process, for example, through reduction in the time elapsed to perform the process (Davenport 1993, p.49). The description of *informational* impact has changed from being *bringing information into the process* to *capturing process information.* The reason for this change is unclear as both impacts may be possible and even beneficial. The first impact describes the informating effect for those who work in the process and the latter the use of process information for management purposes. The *geographical* impact is referred to as being *coordinative* rather than *making processes independent of geography.* The new description for this impact is at least vague and it does not fully comply with the more detailed explanation found later in the book. In addition, it can be interpreted in many different ways. We might consider the description to refer to an organization being able to organize and coordinate work independent of some geographic locations. However, we might also want to consider the ability of an individual worker to work independent of any location. This mode of working is often referred to as "telework". There is a difference which clearly has some implications on the design of a new process. The latter option offers perhaps more potential for radical redesign. The *transactional* capability has even been completely left out. This may be reasonable, because "transforming an unstructured process into routinized transaction" can easily be done even without any impact of IT. The rest of the IT capabilities in this list have remained much the same throughout this revision.

Earl and Khan (1994) summarize some of the earlier work to conclude that information technology can be divided into three classes that each have their own economic contribution and provide different opportunities for changing business processes (Table 3-2).

The process opportunities presented by Earl and Khan (1994) are by their content much the same as those mentioned earlier by Davenport and Short (1990) and Davenport (1993, p. 51). There are, however, some minor differences. For example, Earl and Khan present the opportunity for modeling and conceptualizing processes which is typically more of an implementation issue rather than a real opportunity to use IT to change business processes. In addition, the "sequential" impact mentioned by Davenport and Short (1990) is completely missing. This impact might, of course, result from elimination of activities which is listed above.

TECHNOLOGY	ECONOMIC SCOPE	PROCESS OPPORTUNITIES
COMPUTATION	Reduce Costs of Production	Automating data dependent tasks Disintermediating information processes Eliminating activities
COMMUNICATIONS	Reduce Costs of Coordination	Collapsing time and space Integrating tasks and processes Distributing and collecting data/information
'INFOWARE' (Databases and Systems)	Reduce Costs of Information	Monitoring processes and tasks Analyzing information and supporting decisions Archiving and making sense of experience and expertise Modeling and conceptualizing processes

Table 3-2. IT Opportunities in Business Process Redesign (Earl & Khan 1994)

The above classification of information technologies could also be expressed in terms of more generic IT capabilities. According to Huber (1990) these capabilities are: information *processing* capability, information *transmission* capability, and information *storage* capability. Presented this way the focus is not on technology itself but on how the technology is used. Although the above technology classes have these corresponding basic capabilities, in reality, these technologies are used together and not by themselves. For example, even when the storage capability of IT is primarily provided through database systems (infoware), these systems also need some information processing capabilities to provide information retrieval functions. Similarly, communication technologies seldom work very well without any computing technologies in order to be able to transmit information.

Functional Coupling Framework

Surprisingly, only one attempt has been made towards building a framework of how information technology can transform business processes. Teng et al. (1994b) have proposed such a framework (Figure 3-2) which is based on their analysis of the different ways functions are organized to perform a process, i.e. functional coupling patterns found in business processes. The authors use the term 'function' to refer to a group of workers involved with a particular process within some functional department. For example, they consider a group of researchers working on the same issue being a 'function' within a functional department, research and development.

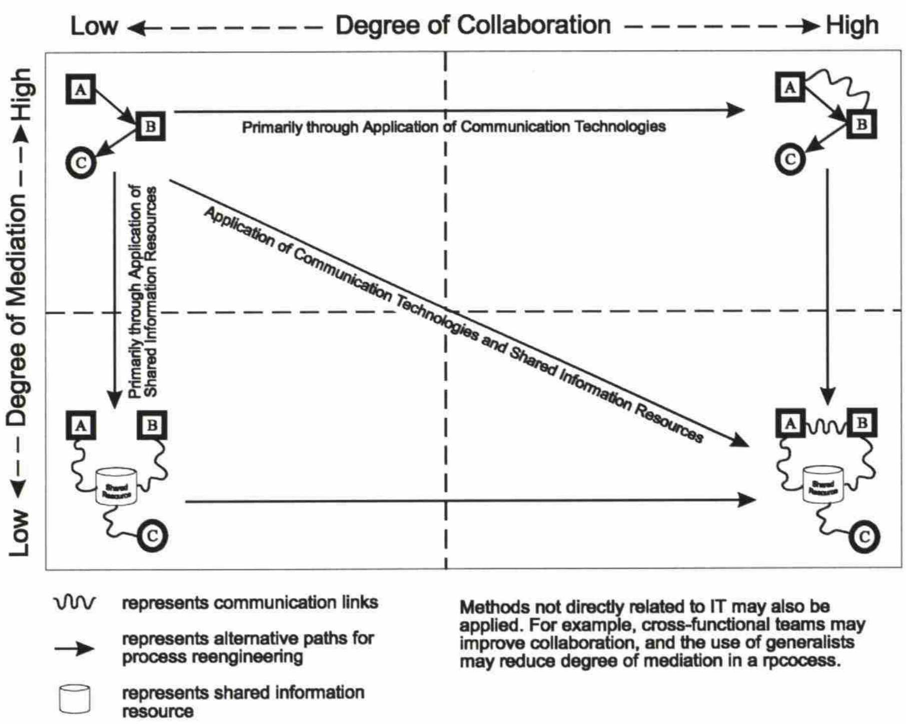

Figure 3-2. Application of IT in Alternative Paths for Process Reengineering (Teng et al. 1994b)[1].

Teng et al. identify two dimensions in functional coupling patterns of business processes: *degree of mediation* and *degree of collaboration.* By *degree of mediation* they refer to the extent of *sequential flow of input and output* among the participating functions in a business process. When the degree of mediation is high functions in a process contribute indirectly to the outcome of the process and when degree is low, the contribution to the outcome is direct. The *degree of collaboration* depends on the *frequency and intensity of information exchange between functions and the mutual adjustments* made based on information received. Based on these two dimensions four patterns of processes

[1] The original picture has been slightly simplified for our purposes and some elements have been removed because they were not relevant here.

are identified: high-mediation/low-collaboration, high-mediation/high-collaboration, low-mediation/low-collaboration and low-mediation/high-collaboration. The authors suggest that information technology can be used to either increase the degree of collaboration or to decrease the degree of mediation. (Teng, et al. 1994b)

Although the basic proposition of this framework, the two dimensions of process changes, can be agreed on and these changes in business processes easily identified, some criticism for the presented arguments is justified.

First, the case of the Ford Motor Company's procurement process (e.g. Hammer & Champy, pp. 39-42) used by the authors as an example to highlight the shifts from high to low degree of mediation and its appropriateness for this situation can be questioned. The authors argue that due to reduction in the degree of mediation in the process, the company achieved 75 % reduction in the workforce. This conclusion is hardly accurate. In fact, the reduction in the headcount in accounts payable department was mainly due to elimination of redundant work which originated mainly from errors made elsewhere in the process and also a result from elimination of invoices (Hammer & Champy 1993, pp. 39-42). These improvements in the process did not, however, substantially decrease the level of sequential work and therefore the radical improvements in the process (i.e. reduction in number of personnel) should not be considered only attributable to reduction of sequential work

Second, the use of the other example, Hewlett Packard, presented to highlight the enhancements in the degree of collaboration might also be considered suspicious. The reported improvements in the process might not necessarily be attributable to improvements in collaboration. The reduction in time spent in meetings might only be due to a new electronic communication medium. This does not directly imply increased collaboration, but might only originate from the fact that previously the salesmen were forced to travel back to the office in order to change information and experiences with their peers and superiors. The travel time cut is clearly a result from the previous and if salesmen attend to fewer meetings and travel less they are also able to spend more time with customers which may lead to increase in sales. Therefore, none of the reported improvements might not necessarily be results from increased collaboration. Consequently, it is not necessarily true that deployment of communications technologies in a process would automatically increase the degree of collaboration. The information technology will most likely increase the amount, speed, and accuracy of the information exchange between two parties, but collaboration takes place only after mutual adjustments occur which may or may not happen.

The changes in processes taking place on the two dimensions of the above framework are similar to some of the process opportunities identified by, e.g. Davenport and Short (1990), and Earl and Khan (1994). Reduction in the degree of mediation is similar to or almost the same as IT's capability to "enable changes in the sequence of tasks in a process, often allowing multiple tasks to be worked on simultaneously". The issue with increase in the degree of collaboration is a bit more complicated. However, because in the context of collaboration, the primary impact of IT is, as noted earlier, to increase the amount, speed, and accuracy of the information exchange, we might consider this dimension analogous with process opportunity of "distributing and collecting data/information". Because of this analogy, the functional coupling framework might be best considered an extension and a more detailed description of the process impacts presented earlier.

Enabling Information Technologies

The approach taken above considers generic IT impacts on processes and does not necessarily indicate any specific technology to facilitate the intended process changes. Different approach, however, as taken by Hammer and Champy (1993, pp. 92-101), is also possible. They describe the impact of IT on business processes by focusing on some specific technologies. They propose that process designers should start "thinking inductively" and try to recognize business problems that modern information technology might solve. Hammer and Champy (1993, pp. 92-101) conclude that IT with its "disruptive" ability can break the old rules of working and organizing work. Hammer and Champy also provide some examples of these disruptive information technologies (Table 3-3).

OLD RULE	DISRUPTIVE TECHNOLOGY	NEW RULE
Information can appear in only one place at on time	Shared databases	Information can appear simultaneously in as many places as needed
Only experts can perform complex work	Expert systems	A generalist can do the work of an expert
Businesses must choose between centralization and decentralization	Telecommunications networks	Businesses can simultaneously reap the benefits of centralization and decentralization
Managers make all decisions	Decision support tools (database access, modeling software)	Decision-making is part of everyone's job
Field personnel need offices where they can receive, store, retrieve, and transmit information	Wireless data communication and portable computers	Field personnel can send and receive information wherever they are
The best contact with a potential buyer is a personal contact	Interactive videodisk	The best contact with a potential buyer is effective contact
You have to find out where things are	Automatic identification and tracking technology	Things tell you where they are
Plans get revised periodically	High performance computing	Plans get revised instantaneously

Table 3-3. Information Technologies that Break Old Rules of Organizing Work (Hammer & Champy 1993, pp. 92-101).

Of course, the above list of technologies is only a small fraction of information technologies available today and this kind of list is only useful in pointing out that work can be done differently with information technology than without it. In addition, many of the change effects presented above can actually be achieved with other technologies than the ones identified here and the above technologies can also have other impacts than mentioned above. For example, decision support tools not only enable 'non-managers' to make decisions but they also often improve the quality of decision making regardless of the decision maker. Therefore, this list is more useful in highlighting the often outdated of mode of thinking about work than in providing a framework for identifying change opportunities, although it does provide some useful practical examples.

Generic Process Applications

Davenport (1993, pp. 55-63) has further developed the idea of process specific opportunities for information technology that was originally presented by Davenport and Short (1990). They proposed that different types of processes need different forms of IT support. Davenport (1993, p. 55) concludes that as the primary designers of new processes should be non-technical people, the IT capabilities should not be expressed in technical terms as these may be meaningless to others than IT professionals. It would, therefore, be more useful to approach the issue by considering some *generic process applications* (package of hardware, software, information, and communications) that solve typical problems encountered in business process. Some generic processes and examples of enabling generic applications are listed in Table 3-4. Examples of underlying technologies, uses of these applications and the problems the applications solve in these processes have been included.

Business process	*Generic application*	*Improvement objectives / Process problems*	*Examples of technologies*	*Example uses*
Product Development	Automated design	Increase speed of design make decisions	CAD, expert systems, graphic workstations	rapid graphical design, alternative design evaluation & selection,
	Simulation systems	Simulate process performance	3D graphic workstations, virtual reality	process/product design simulation, systems prototyping
	Tracking systems	Track product status	project mgmt systems	product/project status tracking, resource consumption monitoring
	Decision analysis systems	Making decision about resource allocation and market roll-out	expert systems	product launch decisions, financial planning, resource allocation
	Interorganization communication	Co-ordinate product design information	electronic messaging, bulletin boards, databases	exchange of design information, project progress reporting
Order Fulfilment	Product choice systems	Increase customer satisfaction with order	expert systems, databases	facilitate choosing complex products
	Microanalysis and forecasting	Eliminate costs and other resources		predicting customer demand at individual level
	Voice communications	Speed delivery	voice messaging	improved communication, automated customer identification,
	Electronic markets	Speed delivery, increase customer satisfaction with order	videotext	electronic catalogues, bidding, auction, spot-pricing
	Interorganizational communications	Speed delivery, eliminate costs	electronic data interchange	transaction generation, sending purchase information & invoices
	Textual composition	Speed delivery		automatic generation of proposals
Logistical	Locational systems		communications, satellites, cellular radio, pager	determine location of materials or vehicles
	Recognition systems		biometric systems	object identification
	Asset management			automated cash management, asset use optimisation
	Logistical planning systems		expert systems	routing and scheduling planning
	Telemetry		microwave, radio	remote monitoring of objects

Table 3-4. Generic Process Applications (Davenport 1993, pp. 55-63).

3.4 Information Technology as a Constraint

Typically, companies have made investments on hardware and software that cannot easily be abandoned in the relevant time frame. This means that information technology can limit the choices a company has when building new systems for new business processes. It also means that some opportunities for changing processes might be unavailable for that company (Davenport 1993, p. 50, Earl & Khan 1994). Additionally, abandoning the old systems and acquiring new technologies may be an economically infeasible option for the organization.

Another constraint imposed by IT is that the development cycles of new systems can be long (e.g. Stoddard et al. 1994). Even if the software development cycles could be acceptable in terms of the design of the new process (i.e., the design would still be valid within the time frame), it might be so that the technologies chosen today are obsolete by the time the new systems are finally rolled out. This is increasingly the danger today when technological advancements occur in a rapid pace.

The rapid advancements in technology also pose the IT personnel in challenging and difficult situation when they constantly need to be aware of opportunities provided by emerging technologies. In addition, when a technology is chosen as the basis for the new applications, the IT function may lack the necessary development skills to build the applications or technological expertise to support the chosen technologies (Caron et al. 1994, Jarvenpaa & Stoddard 1994, Grover et al. 1995).

Many of above and also other problems are highlighted in the case of Nokia Telecommunications (NTC). At NTC, a prerequisite for implementing the new systems was to build a common IT infrastructure. It would have been impossible to implement the new global logistics process with the existing systems and the fragmented infrastructure. In addition, sudden design changes of the new systems led to longer systems development cycle which delayed the project some months. The management at NTC also recognized the risk of the skill development of internal IT personnel as the development team of new systems consisted mainly of outside consultants. (Jarvenpaa & Tuomi 1995)

3.5 FRAMEWORK OF THE STUDY

The framework of the study (Figure 3-3) is derived from the proposition of "IT-Process-Productivity" relationship by Davenport (1993, p. 45). It also builds on the works of Davenport and Short (1990), Earl and Khan (1994), and Huber (1990). This framework mainly summarizes the previous work in this area which we reviewed in the previous section. The functional coupling framework of Teng et al. (1994b) is subsumed into the process opportunities presented by other authors and therefore it is not separately mentioned in this framework. The framework for the study is actually a descriptive model which shows how information technology affects the design of new processes, acting both as an enabler and a constraint.

As suggested by Earl and Khan (1994), the main sources of IT impact on business processes are the three underlying core information technologies: computing, communications, and databases (or database management systems, DBMS). These basic technologies have corresponding core capabilities: information processing, information transmission, and information storage and retrieval (Huber 1990). The core capabilities of IT provide the basic functionality of information systems and IT applications. IT applications can be either generic in nature like decision support systems, or business process specific like locational systems used in logistics processes. Depending on their functionality, applications provide different opportunities for changing business processes. These process opportunities or capabilities are expressed either in terms of observed changes in business processes, or in terms of the use of the technology. For example, the automational capability of IT can be observed as reduced human labor in a process and tracking capability as use of IT to provide process status information. In reengineering, these opportunities are utilized to change business processes in order to meet the new performance objectives. These objectives should be drawn from customers' needs and/or strategic goals.

While information technology offers opportunities, it can also be a constraint. The existing information technology infrastructure may limit the choices an organization has for changing business processes. Organizations can also be restricted by the resources available (e.g. skilled IT personnel, funds). In addition, the old processes may have some known problems and deficiencies which should be taken into consideration when designing the new process.

After the business process has been reengineered we should be able to observe some economic benefits such as reduction is costs, improvements in quality or reduction in the time taken to execute the process.

This framework combines a much larger set of elements than covered in this study and they are presented here only for the sake of completeness. In this study, we will only focus on the following elements: the information technologies used in reengineering (Core Technologies and IT Applications in Figure 3-3), the process opportunities these technologies provide (Process Opportunities), constraints set by information technology (Constraints & Known Problems), and observed process changes (Process Changes).

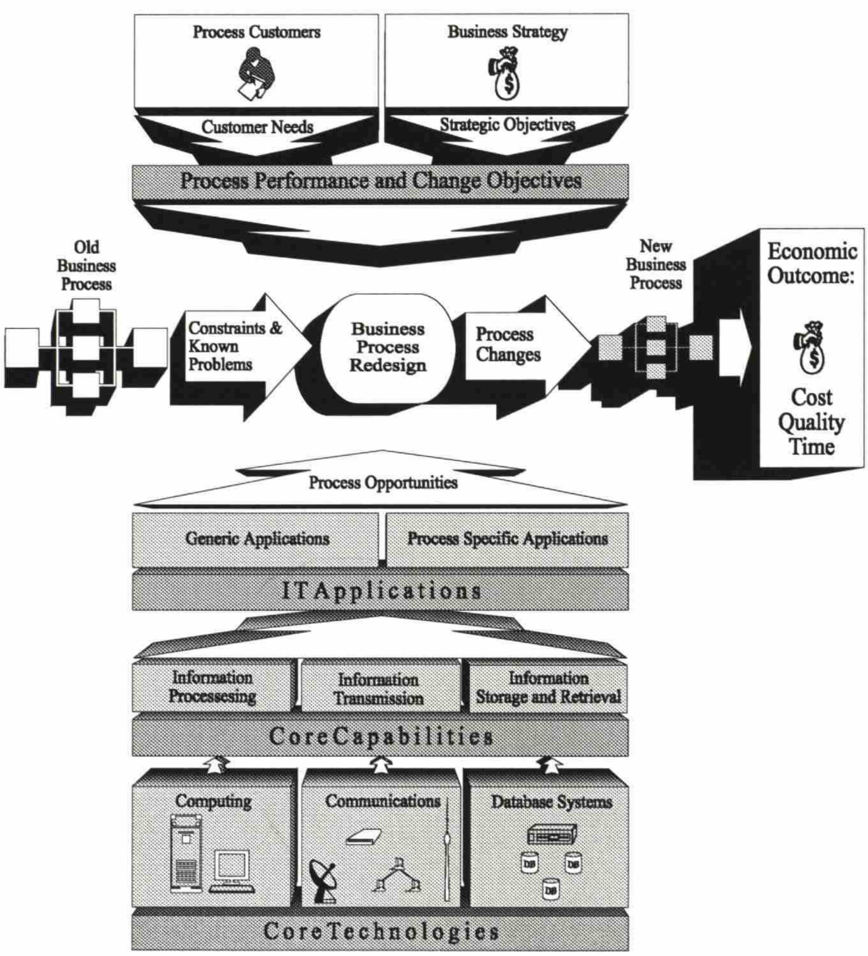

Figure 3-3. Framework of the study

4. EMPIRICAL STUDY

4.1 RESEARCH QUESTIONS

The model presented in the previous chapter guided the formulation of three research questions which we felt needed further clarification in this area. Additionally, there was also a need to empirically test the usefulness of the models presented in the literature about the role of IT and its impacts on business processes. We focused on the following key questions:

1. **What is the role of information technology in BPR? Is it a constraint or an enabler?** In the model above, these two roles act as inputs to redesign of business processes. Because there are slightly controversial opinions and research findings on the overall importance and role of IT in BPR, we formulated this as one of our three research questions.

2. **What information technologies are used in BPR efforts?** Underlying the opportunities for changing business processes are the specific information technologies and systems. Therefore, we needed to examine the possible enablers of change.

3. **What are the perceived impacts of IT on business processes?** The utilized technologies should, according to the above model, result in observable process changes or have other beneficial uses and therefore we needed to examine the perceived impacts of the enabling technologies.

4.2 METHODOLOGY

The empirical data were gathered both by a two-phase mail survey which was carried out during the first half of 1995 and some structured interviews. In the first phase of the mail survey, a short questionnaire (appendix 1) was sent to 287 large Finnish companies. The selection of these companies was based on an annual listing from

Finnish Talouselämä magazine. The target group were executives responsible for information technology in the company. After follow-up letters and phone calls total of 93 responses were received giving a response rate of 32,71 %.

In the second phase, a more detailed questionnaire (appendix 2) was sent to projects managers responsible for the actual reengineering efforts. These persons were named by the respondents of the first questionnaire. We received total of 14 responses. Structured interviews based on the second-phase questionnaire were also carried out in three companies resulting in data for additional five BPR projects.

After we discarded the projects that were either too incomplete or could not be considered as BPR efforts we wrote 15 minicases based on the data from the interviews and responses received from the second-phase questionnaire (for further details, see Kallio et al. 1996). The minicases were then sent to the respondents for approval and possible error checking. One of these cases was also discarded here because of lack of data for the questions concerning this study leaving fourteen case examples to be analyzed.

Because the response rate for the first questionnaire was rather low, many companies were asked the reason for not responding. Some of the typical answers were:

- information about the project was considered confidential;
- top managers receive often too many questionnaires and they do not typically have the time nor the interest to respond;
- BPR was considered a management fad and therefore not worth the effort of responding;
- managers were not familiar with the concepts of BPR.

4.3 RESULTS

4.3.1 General Profile of the Cases

The projects analyzed here vary greatly in many aspects. The size of the projects (measured in budgeted costs) ranged from 17 Million to 50000 FIM. The time frame for the projects was on the average 17 months, but variance was from 6 months to 38 months. In addition, at the time of the writing some projects had not yet been completed.

Majority of the processes reengineered were considered core processes (8) and some were viewed as support processes (4). Only one process was seen as being a managerial process and one effort concerned a subprocesses of a larger support process. The change outcomes of the projects as measured by scope and depth of the processes also varied. In two of the projects, the reengineered process was only within one function, but on the average the processes cut across 5.8 functions, standard deviation being 3. The depth of the changes was in all cases at least moderate but, typically, (on a scale of 1=none to 5=very much) it was closer to 4. Majority of these projects were then typically either in the quadrants of "Ttransformational BPR" or "Implementation of a common system or a procedure" (For a more detailed discussion, see Kallio et al. 1996).

In the following sections we analyze the data gathered from projects by each research question first concentrating on general level observations and then analyzing the individual cases.

4.3.2 Information Technology in Finnish Reengineering Efforts: an Enabler or a Constraint?

In the section D of questionnaire, "The Use and Impact of Information Technology on processes", the first set of questions covered areas such as changes in the IT infrastructure and information systems, and also the perceived importance of IT impact on processes.

The questions asked in the questionnaire were

- How much did your company's existing IT infrastructure constrain the development of new information systems?
- How much was the existing IT infrastructure changed due to requirements of the effort?
- How much were the existing information systems changed due to requirements of the effort?
- How many new information systems were developed?
- How important is information technology for execution of the redesigned process?

Additionally, we included a question concerning the IT personnel role in another section of the questionnaire where the general profile of project was examined. We presented a list of statements for the respondents to evaluate. These statements were evaluated on a scale ranging from totally disagree to totally agree. Our statement was

- The IT department was able to meet the challenges set forth by the project.

The findings from this survey seem to support the propositions found in early BPR literature (Hammer 1990, Davenport & Short 1990, Davenport 1993) that information technology plays a major enabling role in process reengineering efforts. Twelve companies out of the total of 14, considered information technology to have at least a lot of impact on the processes reengineered and seven of these even viewed the impact to have been substantial (very much impact). In the last two cases, the perceived impact was considered some and none of the companies considered IT to have no impact at all.

Most of these cases also support to some extent the conclusions found in literature that information technology may be a constraint to reengineering. Eleven of the companies considered their IT infrastructures to be at least a little restricting.

However, as ten firms (25 % of the companies) also made at least some or even considerable (44%) changes to their IT infrastructures it also seems that companies are either willing or forced to invest on IT infrastructure to be able to build new systems to support business processes.

Still, even though the basic IT infrastructure (operating systems and platforms, networks etc.) would not require major changes most of the companies have done at least some (29% of the companies) or even major (50%) changes to their existing information systems. The natural continuum for this can perhaps be seen in the results of new information systems built which show that 80 % of these companies also built at least some new systems. Overall, we may conclude that these companies seem to view their IT infrastructures as constraining and therefore make substantial changes to them. In addition, simultaneously with the infrastructure changes the existing systems need to be changed. It also seems that the new systems have called for these changes. Consequently, the impact of IT on processes is perceived as high. For details, see Table 4-1.

Question / Response category	*None (1)*		*Little (2)*		*Some (3)*		*A lot of (4)*		*Very much (5)*		***Total***	
IT infrastructure constraining	3	(21 %)	1	(7 %)	4	(29 %)	3	(21 %)	3	(21 %)	**14**	**(100 %)**
Changes to IT infrastructure	2	(14 %)	2	(14 %)	4	(29 %)	3	(21 %)	3	(21 %)	**14**	**(100 %)**
Changes to existing information systems	0	(0 %)	3	(21 %)	4	(29 %)	4	(29 %)	3	(21 %)	**14**	**(100 %)**
New information systems required	2	(14 %)	1	(0 %)	3	(21 %)	3	(21 %)	5	(36 %)	**14**	**(100 %)**
Impact of IT on processes	0	(0 %)	0	(0 %)	2	(14 %)	5	(36 %)	7	(50 %)	**14**	**(100 %)**
IT personnel's ability to meet challenges	0	(0 %)	1	(7 %)	2	(14 %)	6	(43 %)	5	(36 %)	**14**	**(100 %)**

Table 4-1. IT Infrastructure, Changes and Impact of Information Technology on Processes[2].

Some authors have also observed that the IT staff may not always be able to meet the challenges of the reengineering effort and that this might also reduce a company's ability to exploit information technology (Caron et al. 1994, Jarvenpaa &

[2] For the last question concerning the IT personnel the response categorization was from 1=totally disagree to 5=totally agree. See appendix 2 for more details.

Stoddard 1994). However, when we asked whether these Finnish companies felt that their "IT personnel was able to meet the challenges of the effort", 79 per cent of the respondents agreed that they were, at least to some extent. None of the respondents saw their IT personnel as not being able to meet the challenges at all.

Case Results

Next section shortly describes each of the cases following the structure of the questionnaire. The answers given in the questionnaire are listed in Table 4-2.

Question / Case No.	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*Avg.*
IT infrastructure constraining	5	4	4	1	5	1	1	4	3	5	3	3	3	2	**3.1**
Changes to IT infrastructure	2	4	4	2	4	5	3	5	3	5	1	3	3	1	**3.2**
Changes to existing information systems	2	4	4	5	4	5	3	4	3	5	3	2	3	2	**3.5**
New information systems required	5	3	4	4	4	5	3	5	3	5	1	2	1	5	**3.6**
Impact of IT on processes	5	4	5	4	4	5	3	5	4	5	4	3	5	5	**4.4**
IT personnel's ability to meet challenges	5	4	4	4	2	5	5	4	3	4	4	3	5	5	**4.1**

Table 4-2. IT Infrastructure, IT Impact and IT personnel. Responses by case
(Scale: 1=none or totally disagree, 5=very much or totally agree).

Case 1. WoodSubCo's redesign of 'raw materials acquisition and logistics' process is highly IT enabled. Their objective was to exploit modern IT to build logistics optimization system together and simultaneously move to team-based control and reward systems. The questionnaire results here are somewhat contradictory. The company's IT infrastructure constrained development of new systems and yet no major changes are made to the infrastructure. Still, the company was able to invest heavily on new information systems. Normally, we would probably assume that when a company has very restricting IT infrastructure, is would be almost impossible to build new information systems (or only with limited capability) unless changes were made. One interpretation of this might be that the respondent has considered "completely new information systems" being this "new IT infrastructure" rather than changes to "existing IT infrastructure".

Case 2. At the time of the survey, MachineryCo was still in the middle of reengineering its tendering process but some preliminary results could be reported. The information technology infrastructure at MachineryCo was considered limiting. Therefore, some major changes needed to be made in order to build new and to fix the old systems. Information technology (laptop computers and telecommunications) also enables the salesmen to work on the road which speeds up the tender preparation and the whole order-delivery process.

Case 3. At CarDealerCo information technology played a very important role. The IS requirements of the new team-based organization called for major investments in new IT infrastructure. Many changes were made to existing IS and new information systems were developed to support the teams. The impact of IT on processes is therefore clearly considerable as the new team-based organization relies on IT support.

Case 4. At FoodSupplyCo, the existing IT infrastructure did not constrain the development of new information systems and therefore there was only little need for changes to the basic infrastructure. However, as the main objective of the effort was to build process wide, integrated information system, the company made substantial changes to existing information systems and developed many new ones. FoodSupplyCo felt that information technology had a major impact on the business process and enabled telework.

Case 5. A reengineering case with a narrower scope is the redesign of the manufacturing process at MetalCoFirst. Their IT infrastructure was very constraining and needed to be upgraded. Also the existing information systems required modifications. New IS were needed to support the new team-based organization. As a result, information technology played an important role in the new process.

Case 6. PlasticCo is a typical example of an order fulfillment process which includes partners and customers. The information technology played a major role in the new process and also considerable investments on the new IT infrastructure were made because of the new technologies (telecommunications, client/server architecture) adopted. Furthermore, the old information systems needed to be changed considerably.

Case 7. The redesign approach taken at WholesaleCo resembles actually more of a large information systems project than a true reengineering case, but as the improvements and changes made are quite radical it may well be discussed here. The redesign of the accounting process required the company to make only some changes to the IT infrastructure although it did not greatly restrict the implementation of the required new information systems. The role of information technology was considered significant although radical changes in the process resulted.

Case 8. At SalesCo major changes to the IT infrastructure are required in order to build the new information systems required to support the logistics process. Also, the old information systems require major changes. Although the project is not yet complete, the design of the new process assumes major impact of IT.

Case 9. WoodCo has also redesigned its logistics process, but contrary to many previous examples, it has not been forced to do any drastic changes to either IT infrastructure or old information systems. Still, some constraints have been identified and also some changes made both to the infrastructure (electronic mail) and the information systems (e.g. improvements in old expert and control systems) as well as new IS built. Still, regardless of the modest changes or number of new IS the impact of IT on the process have been considered substantial.

Case 10. Information technology has been of great importance in the reengineering effort of order-delivery process at ElectricCo. The IT infrastructure required many changes. The old information systems went trough revisions and new systems were built. The use and impact of information technologies on the business process was substantial and changes versatile.

Case 11. The IT infrastructure at MetalCoSecond set some constraints to the development of new systems for the logistics process. The company, however, made no changes to their infrastructure to overcome these constraints. Instead, they made some changes to existing information systems to better support the redesigned process. No new information systems were built. Even the existing and modified systems had a lot of impact on the reengineered business process.

Case 12. Similarly, as in the previous case of MetalCoSecond, MetalCoThird felt that their infrastructure imposed some limitations and therefore some changes to it were implemented. However, the reengineering effort called for only little changes to existing information systems. Likewise, only very few new systems were built. IT did not play a crucial role here and had only some impact on processes.

Case 13. At BankCo, the redesign of their communications processes were to some extent constrained by the existing IT infrastructure. Therefore, some changes were made to the infrastructure. In addition, some changes were made to the existing information systems. No completely new systems were built as the existing technologies (electronic mail) and information systems were further exploited. Information technology also enabled completely new way of organizing work with significant performance improvements.

Case 14. CompuCo considered their IT infrastructure to place only little restrictions on development of new applications for the process and therefore no changes were necessary. The existing systems were also largely left intact. The new process did, however, require substantial development of new systems. These systems played a major role in the new process.

4.3.3 Information Technologies Used in Finnish BPR Efforts

Popular BPR literature often urges companies to "use the power of modern information technology to radically redesign our business processes" (Hammer 1990) and also gives number of examples to highlight the use of some specific technology with its enabling or 'disruptive' capabilities (e.g. Hammer & Champy 1993). Authors also often refer to successful cases where state-of-the-art information technology is used (e.g. Hammer & Champy 1993, Davenport & Short 1990, Davenport 1993). Therefore, the second question in our survey concentrated on the use of specific information technologies. We asked "What information technologies were used to improve the business processes?"

The results of the survey seem to support the idea that at the same time when business processes are being reengineered companies are typically entering the so called "Network Era" in their information technology adoption life cycles (Nolan 1995). In fact, most (10 out of 14) of the information systems reported in these cases rely on some form of communications technologies (telecommunications, local area networks, email etc.). It is also evident that these companies are in various stages of the life cycle as some seem to be adopting basic technologies whereas others have started to implement more advanced systems. Still, very few have actually taken advantage of any state-of-the art technologies available (an exception here might be case 1, WoodSubCo). Table 4-3 lists the information technologies, information systems and other related information reported by these companies.

Case No	*IT / IS*
1	Satellite navigation system, digital map, telecommunications (Mobitex)
2	Shared databases, decision support systems, telecommunications, portable computers
3	Shared databases, telecommunications
4	Local area network (LAN), integrated IS, telework
5	Telecommunications / LAN
6	Telecommunications, client/server systems
7	Telecommunications, shared databases
8	Expert systems
9	Expert systems, electronic mail, control systems
10	Databases, telecommunications
11	Logistics IS, ABC Flowchart software
12	Project management software
13	Email, bulletin boards
14	Lotus Notes (groupware), email

Table 4-3. Information Technologies Used

Of course, a mail survey like this one with only limited number of questions, gives only a rough overview of the information technologies used and their functionality, which actually causes the impact on processes may remain vague. A more in-depth study of the information systems, their functionality and the information use would be needed in order to be able to make any valid generalizations or to draw accurate conclusions.

Most of the processes reengineered in these cases seem to fall into two categories: logistics (cases 1, 4, 8, 9, 11) and order fulfillment (2, 3, 6, 10) processes. Other processes might be categorized as product development (12), communications (13), accounting (7), manufacturing (5), and maintenance (14) processes.

If we map the IT solutions reported to the processes reengineered following Davenport's (1993) ideas of generic process applications, it would at first glance seem that both logistics and order fulfillment processes here do exploit the same underlying technologies identified earlier with generic process applications (see Table 3-4, p.40). At a closer look, however, if we consider the functionality of these systems, many of them do not actually fit well in any of the generic process application categories. Only a few examples of a good match can be found. In the case of WoodSubCo, where the company used a digital map and satellite navigation system in a logistical process to track and optimize transportation of raw materials, we might easily consider their system being a "locational system". Similarly, the project management software used by MetalCoThird falls was identified as an enabling technology in product development processes. As for most of the other cases, however, it is possible to make only speculative assumptions and not really valid conclusions because of the amount of data gathered for this question in the study.

Case Results

Case 1. The logistics process at WoodSubCo exploits two types of generic logistical applications. Their information system that used digital map combined with satellite navigation system is a typical "locational system" which is used to track the location of goods and vehicles. The information gathered by the system is used to optimize transport of raw materials and it possibly also has some functionality of a "logistical planning system". This case is also perhaps the only one where so called state-of-the-art information technologies are used.

Case 2. MachineryCo's order fulfillment process consists of three different sub-processes: 1) sales and marketing, 2) order to delivery, and 3) after sales. Although the information systems built for the reengineered process supported all the three phases, the most advanced systems were perhaps implemented for the first phase. These systems enabled sales representatives to prepare tenders while traveling and on customer sites as they employed portable computers connected to company information resources via telecommunication networks. The company also took advantage of expert systems. Of course, we can only speculate but, the technologies used and functionality of the systems would indicate some kind of product choice system.

Case 3. The information systems and technologies exploited at CarDealerCo do not fall into any of the generic application categories of order fulfillment processes listed earlier (Table 3-4, p.40). The systems implemented at CarDealerCo were order entry and sales systems based on shared databases and telecommunications. These systems enabled the company to move to a team-based organization, improved decision making and coordination.

Case 4. At FoodSupplyCo the objective was to build an integrated information system to support the logistics and materials management. Judging by the description found in the questionnaire it is hard to picture this integrated system as any of the generic logistics applications suggested by Davenport (1993, pp. 55-63). It would probably be best described as "logistics information system" which have multiple functionalities but where one of the main objectives is to avoid re-keying information generated during the process. As with any integrated information system, the key enabling technologies would probably be databases and communications networks (LAN, wan).

Case 5. Manufacturing processes have been subject to redesign with technology (perhaps other than IT) for decades. At MetalCoFirst, the reengineering of manufacturing process aimed at improving the efficiency and control of the process. The introduction of a local are network at the manufacturing site enabled the company to collect information about the process and helped in better controlling its execution.

Case 6. The reengineered process at PlasticCo was an order fulfillment process (order-production-product delivery) that cut across both subsidiaries and customers. The information received about underlying technologies was scarce. However, because the functions supported by the new information systems (order entry and production planning), would indicate that the client/server systems built might be considered as interorganisational communications applications which relied on telecommunications infrastructure (a necessity for c/s systems).

Cases 7. WholesaleCo's aim was to improve their accounting process to be able to deliver consistent and reliable accounting information. This was achieved by centralizing the accounting information systems from several machines in district offices to one in headquarters. This required high-bandwidth telecommunications infrastructure as well as efficient and reliable database systems.

Case 8. The data from the SalesCo case is minimal because the effort is not yet completed, but some conclusions can be made. The logistics process reengineered will most likely make use of some kind of "logistical planning systems" because the new information systems will exploit expert systems technology and the objectives for the process were reliability of the transportation, reduced cycle times and lower prices for transporting the goods.

Case 9. The second case of WoodCo is also a very typical logistics process. Although for this process the company did not build any new "logistical planning systems", the old systems that were improved would perhaps best fall into this generic application category. In addition, the company introduced electronic mail, but its application area in the logistics process remains slightly unclear.

Case 10. The order fulfillment process at ElectricCo seems to utilize the same applications as PlasticCo in case 6. Order entry systems seem to be a common nominator for these order fulfillment processes that strive to meet the customers' needs efficiently. These systems, are typically based on databases and they also employ telecommunications to provide cross-functional and perhaps interorganisational information access.

Case 11. At MetalCoSecond, no new information systems were built to support the redesigned process. The existing logistics systems were modified to meet the requirements of the process. The company also used the ABC Flowcharter modeling software to analyze and conceptualize the processes.

Case 12. At MetalCoThird, the company uses a project management software which was identified by Davenport (see Table 3-4, p.40) as enabling generic process applications in product development processes.

Case 13. BankCo's enabling technologies were electronic mail and bulletin boards. In Finnish banking industry where the basic IT infrastructure often consists of mainframes and terminals (today, terminals may, of course, well be standard PCs) these technologies sound like natural choices. Increasingly, however, companies are choosing information technologies such as the World Wide Web to facilitate their information processes and information sharing. Lately, we have also seen the introduction of electronic commerce technologies which are likely to offer new enablers for banking processes.

Case 14. CompuCo was the only company of these fourteen studied here to use groupware technology in their reengineering effort. They used a groupware product, Lotus Notes, to build a workflow application to be used throughout the process. Electronic mail was also utilized together with this application.

4.3.4 The Perceived Impact of Information Technology on Business Processes

In previous sections we studied the importance of IT in Finnish business process reengineering efforts and also what are the specific information technologies used in different types of processes. The next section seeks to provide some insights on what are the actual benefits from using IT, what process opportunities of information technology are exploited, i.e., what are the impacts of information technology on processes that companies seem to experience.

In the questionnaire we asked: "Which of the following process opportunities of information technology were exploited in this effort?" We gave a list of the process opportunities presented in BPR literature. This list was primarily based on the summary list by Earl and Khan 1994 but, we added the item "changing process sequence or enabling parallelism" which we felt was obviously missing and important. The responses to this question for the 14 cases are presented in Table 4-4 with total amount of responses for any individual item on the list.

A general observation of the results is that, none of the listed process opportunities was completely omitted in these cases and some companies even feel that they have been able to exploit most of them. For example, in case 4, the company exploited 9 out of 12 opportunities listed, and in case 10, even 10 out of 12 were used. There seems to be no positive correlation to the amount of opportunities utilized and the performance improvements achieved. Almost the contrary, two companies where only two of the listed opportunities where exploited, reported the most impressive results.

It seems that not all case companies have used IT for "automating data dependent tasks". Only five companies (36% of the respondents) reported to have used this opportunity. This result seems to be slightly in contradiction with Davenport's (1993) opinion that "automational" impact is the most commonly recognized benefit from IT. At the other end, the most commonly used methods of changing processes through information technology seem to be here "analyzing information and supporting decisions" (71%), "monitoring processes and tasks" (71%), "distributing and collecting data and information" (64%), "disintermediating information processes" (57%), and "integrating tasks and processes" (57%). All of these impacts or opportunities could perhaps be easily characterized as well known uses of information technology and therefore, this result is not very surprising.

Process opportunities / Case	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***	***13***	***14***	***Total***
Automating data dependent tasks				1					1	1	1			1	5 (36 %)
Eliminating activities				1			1	1	1	1	1				6 (43 %)
Integrating tasks and processes	1	1	1	1			1	1		1				1	8 (57 %)
Changing process sequence or enabling parallellism		1	1	1						1					4 (29 %)
Disintermediating information processes		1	1		1	1			1	1		1		1	8 (57 %)
Distributing and collecting data / information	1	1		1	1	1		1	1	1		1			9 (64 %)
Analysing information and supporting desicions	1	1	1	1	1	1		1		1		1		1	10 (71 %)
Archiving and making sense of experience and expertise		1	1	1						1			1		5 (36 %)
Collapsing time and space		1		1		1			1	1					5 (36 %)
Monitoring processes and tasks	1	1	1	1	1	1			1	1		1		1	10 (71 %)
Modelling and conceptualising processes	1										1	1	1		4 (29 %)
Other opportunities?															0 (0 %)
Total	5	8	6	9	4	5	2	4	6	10	3	5	2	5	

Table 4-4. Process Opportunities of IT Exploited in Finnish Companies

Case Results

Case 1. WoodSubCo began its reengineering effort both to try out concepts of redesign and to exploit the opportunities in exploiting new technologies. New satellite based systems and digital maps enabled mainly collection and distribution of information which could then be analyzed and used to make optimal routing decisions. New systems also permitted task and process integration and status monitoring.

Case 2. The reengineered customer service (or order fulfillment) process at MachineryCo seems to have utilized majority of the IT opportunities listed. New sales systems have enabled the salesmen to prepare tenders using portable computers regardless of their location and global time differences. Furthermore, using modems they can connect to company's information systems to distribute sales information and gather product information needed to prepare the tender. With direct access to company databases, the unnecessary information intermediaries are eliminated. Information technology has enabled higher integration of some tasks and processes and also enabled their parallel execution. In addition, the information captured by the systems can be used both for monitoring the customer service process and to support decision making. The experiences of field personnel can now be recorded and later used by other employees to learn and to improve their own expertise.

Case 3. The objective at CarDealerCo was to streamline the order-delivery process of new cars in order to achieve increased customer satisfaction due to reduced cycle times. The new process was based on teams which were supported by order entry and sales systems. These systems enabled the company to integrate some tasks and processes and also eliminate intermediaries from a process while moving towards a more parallel mode of task execution. These exploited technologies enabled the company to improve analysis of information and supported decision making and knowledge creation. Monitoring of processes and tasks were also made possible by the new systems.

Case 4. FoodSupplyCo has utilized almost every process opportunity listed in the questionnaire. The company's integrated information system made it possible to automate data dependent tasks and eliminate activities by making all the information once entered into the system potentially available for all the workers in the process. At the same time, some tasks and processes were integrated and some changed from being sequential to be performed in parallel. Also, now that all the company information is entered only once in the information system and is made available, it is possible to easily distribute it, analyze it and use it for decision making purposes. In addition, the company also started to support telework, which enabled some tasks to be performed regardless of time and place. Lastly, as the process-wide information system captures the information produced in the process, managers would be able to better monitor the process and tasks.

Case 5. Manufacturing process of MetalCoFirst takes advantage of more traditional opportunities of information technology. Collection and distribution of information has been improved by the introduction of a local are network Simultaneously, unnecessary intermediaries have been eliminated from information processes. Once the information is made easily available it can be used for analysis and decision making purposes and for monitoring the performance of the process.

Case 6. PlasticCo improved its order fulfillment process by building information systems to support order entry and production planning in subsidiaries. These new information systems eliminated the information intermediaries in the process and reduced cycle times and also improved collection and distribution of status information of customer orders. Production planning decisions were also improved by the ability to analyze the available order information. In addition, telecommunications systems enabled some tasks to be performed independent of time and place. The introduction of the new systems also required new skills from employees and changed the content of their work.

Case 7. WholesaleCo's accounting processes used to be organized in a decentralized mode where all the sales regions had their own accounting procedures and systems. In the reengineered process, the accounting processes were simplified and the company moved from several independent systems to a single system that would be centrally managed by the head office. By moving to a single accounting system, WholesaleCo was able to eliminate duplicate activities and to integrate accounting tasks and processes. These changes lead to substantial cost, quality, cycle time, and efficiency improvements in the process.

Case 8. The new logistics process at SalesCo will be enabled by expert systems which makes some activities obsolete and makes it possible for the company to integrate tasks and processes. This also reflected in radical changes in company values, in job descriptions, skill requirements of employees, and organizational structures. In addition, the new information systems enable better distribution of process information and improved analysis of information and decision making.

Case 9. WoodCo's new logistics process did not require major IT support but still some process opportunities of information technology were utilized. The old but improved logistics IS automated some tasks while completely eliminating others. The logistics control systems captured process status information that was used to monitor the execution of the process. Introduction of electronic mail allowed better coordination of geographically dispersed activities and easier distribution of information.

Case 10. ElectricCo has been able to exploit most of the process opportunities of information technology. Their order fulfillment process that cuts across company boundaries to customers was supported by order entry systems which automated data dependent tasks and eliminated redundant activities because re-keying of data is no longer necessary. Information technology has enabled parallelism in processes and a higher degree of task and process integration. In addition, information is now better available and distributed throughout the process and can be used for analysis and decision making, for example, in production planning. Monitoring the status of customer orders is made possible by computerized order entry systems.

Case 11. At MetalCoSecond the logistics system automated some tasks in the process and also completely eliminated others. No other impacts were perceived. The use of the flowcharting software helped in modeling and conceptualizing the redesigned process.

Case 12. The project management software used at MetalCoThird helped to eliminate intermediaries in the information flows. It also made it easier for the company to collect information and to distribute it those who need it.

Case 13. BankCo used information technology for archiving and making sense of experience and expertise as well as modeling and conceptualizing processes. These do not, however, sound like the most obvious opportunities for electronic mail and bulletin board systems.

Case 14. CompuCo's groupware based workflow application enabled the company to automate some data dependent tasks as well as integrate other tasks and processes. Unnecessary intermediaries were also eliminated from the information processes. In addition, information technology is used for analyzing process information and supporting decision making. Because the workflow system captures process information, monitoring the process and tasks performed is much easier.

5. SUMMARY AND CONCLUSIONS

The aim of this study was to examine the importance and role of information technology, its use, and impacts on business processes in Finnish reengineering efforts.

In chapter 2, we described reengineering as a vehicle for organizational transformation and discussed the possible change outcomes from BPR, both on a process level and on an organizational level. Chapter 3 focused on discussing in more detail the role of information technology in business processes reengineering, the emphasis being on the enabling role and IT impacts on processes. We also formulated a descriptive model which was used as a basis for the research questions and the empirical part of the study. To find the answers to the research questions, we carried out a two-phase mail survey during 1995 as a part of a larger research project on business process reengineering. In Chapter 4, we analyzed 14 Finnish reengineering efforts.

We found that, in general, information technology is both an enabler and a constraint as suggested by the BPR literature. However, often companies were able to invest in their IT infrastructures to overcome its limitations. Respondents also tended to emphasize the use of telecommunications and databases, both of which are very traditional technologies. At least in these cases, the use of so called state-of-the-art information technologies seems to be rather rare. We observed only one case in which more advanced technology, satellite based navigation, was used. Other technologies exploited were, for example, electronic mail, expert systems, and groupware.

Information technology was most often used to monitor processes and tasks, analyzing information and support decision making, or distributing and collecting information. Other often identified uses of IT to improve processes were integrating tasks and processes, and disintermediating information processes.

A recurring theme in these cases was also the move from functional organizational structures to team-based structures. This move is clearly a step towards the new organization as described in chapter 2. Of course, all these cases with their process orientation are also representatives of the horizontal organizations, although perhaps not at its extremity.

The causal structures in the descriptive model drawn on the literature may well be questioned. Because of this, the 'evidence' found in this and perhaps in other similar studies, can often be labeled as 'anecdotal'. This is especially the case with the causal relationship between IT and resulting process changes. The model described here assumes that the impact of IT on business processes results directly from the application of technology. However, as suggested by Lucas and Baroudi (1994) in a slightly different context the impacts of IT often result from an emergent process and therefore cannot be easily anticipated. Thus, it might be difficult to find good generalisable rules on how some specific technology will affect a business process. This problem, however, is not unique to BPR literature but can also be identified in other literature about the impact of information technology on organizations (see e.g. Markus & Robey 1988).

Generally speaking, one problem in examining the impacts of information technology on organizations or business processes is that often different technologies emerge and die even more quickly than most companies are able to adopt them. Therefore, it may be difficult to find large enough samples of implemented technologies or systems to study empirically and subsequently any studies may fail to provide good generalisable results.

Additionally, it is increasingly difficult to accurately categorize information systems, information technologies, software programs, or even hardware as they are becoming hybrids which leads to difficulties in accurately identifying the true sources of IT impacts. For example, typical groupware product is based on database technology, but it is also essentially build on client/server architecture and it therefore does not function without proper telecommunications infrastructure. Often, groupware products have also a built-in or integrated electronic mail system. Thus, in groupware, we have been able to identify a number of technologies that have been individually identified as single enabling technologies in the popular BPR literature. Therefore, the question arises, where does the actual impact come from - from the databases, or communications networks, or somewhere else? In fact, to make things even more confusing, a groupware product should actually be considered an application development platform, rather than an application itself. The functionality of an application built upon this platform and the information it provides is what eventually will cause any impacts on processes.

Despite any of the above problems, the results from the study clearly emphasize the importance of flexible, well-defined and structured IT infrastructure. It seems that, in some of the case companies, the IT infrastructure was outdated and therefore in the need of upgrading, or as in extreme cases, almost non-existent. This may not, of course, necessarily be a negative sign as the IT diffusion life cycles in companies are often quite different depending on the resources available and also due to industry differences. However, to avoid continued heavy investing in IT attention should be paid to careful infrastructure planning.

It also seems clear that very basic technologies can be used to improve business processes instead of so called state-of-the-art technologies. This would imply that there are untapped opportunities in the current technologies that could be exploited rather than spending time and money on emerging and potentially risky technologies.

In the future, more work needs to be done in this area to build better models on the impact of information technology on business processes which reliably capture causal relationships. Moreover, in order for the new process perspective on IT impacts to be sensible and to avoid the problems mentioned earlier, we need better instruments to be able to accurately measure the IT impacts on business processes. There is also a need to distinguish between the different levels of observation (individual, workgroup, and organizational) as well as primary and secondary impacts of IT.

Additionally, better links between business process change and resulting new organizational forms need to be established. A promising starting point could be, for example, to use the information processing model of the organization (e.g. Galbraith 1977, Tushman & Nadler 1978) and to examine the how information technology affects the basic assumptions of this model and the resulting design choices for organizational structure.

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APPENDICES

Appendix 1

BPR '95 - tutkimus, Mail Survey Questionnaire, First Phase

15.3.1995

Hyvä tietohallinnosta vastaava,

Helsingin kauppakorkeakoulu on käynnistänyt liiketoimintaprosessien uudistamista koskevan tutkimuksen, jonka tavoitteena on muodostaa kokonaiskuva sen yleisyydestä, kohteista, toteutustavoista ja saavutetuista hyödyistä maassamme. Liiketoimintaprosessien uudistamisella tarkoitamme tietotekniikkalähtöistä liiketoi-mintaprosesseihin kohdistuvaa merkittävää parantamista. Sen yleisesti käytettyjä englanninkielisiä vastineita ovat mm. Business Process Reengineering ja Business Process Redesign.

Tutkimuksen kohderyhmänä on ensivaiheessa suuryritysten tietohallinnosta vastaava johto. Toivomme saavamme apuanne yrityksenne kokonaistilanteen hahmottamiseksi sekä kahden teille merkittävän hankkeen analysoimiseksi. Jotta oma ajankäyttönne tähän tutkimukseen ei muodostuisi liian raskaaksi, valittuja hankkeita koskeviin tietoihin voivat vastata esimerkiksi niistä vastanneet projektipäälliköt. Näitä yhteystietoja pyydämmekin tämän kyselyn lopussa hankekohtaisten kyselylomakkeiden postittamista varten.

Toivomme, että edesautatte hankkeemme onnistumista ja vastaatte mahdollisimman pian, kuitenkin viimeistään 27.3.1995 palauttamalla oheisen kyselylomakkeen osoitteella:

BPR'95 - tutkimus
Prof. Ari P.J. Vepsäläinen
Helsingin kauppakorkeakoulu
Runeberginkatu 14-16
00100 Helsinki

Tutkimuksen valmistuttua lähetämme kaikille vastanneille yhteenvetoraportin tuloksista. Luonnollisesti kaikkia tietoja käsitellään luottamuksellisesti, eikä mitään yksittäisiä tietoja tulla julkaisemaan.

Tutkimusterveisin

Ari P.J. Vepsäläinen, Ph.D.
Professori
Logistiikka

Timo Saarinen, KTT
Apulaisprofessori
Tietojärjestelmätiede

Vastaajan yhteystiedot. Korjatkaa mahdolliset virheet, kiitos!

Vastaajan nimi: ____________________
Tehtävänimike: ____________________
Yrityksen nimi: ____________________
Puhelin: __________ Fax: __________

1. Tehdäänkö yrityksessänne prosessilähtöistä liiketoiminnan kehittämistä?

- ☐ KYLLÄ
- ☐ EI, miksi?

Mikäli vastasitte **EI**, olkaa ystävällinen ja **palauttakaa vastauslomake edellä olevaan osoitteeseen**, sillä myös tämä tieto on tutkimuksen kannalta arvokasta. **Kiitämme vaivannäöstänne**!

2. Onko yrityksessänne tehty selvitystä liiketoimintaprosesseista ja niiden kehittämistarpeista?

- ☐ KYLLÄ
- ☐ EI, miksi?

3. Miten liiketoimintaprosessien kehittämis- ja uudistamistoiminta on organisoitu yrityksessänne?

- ☐ Erillinen organisaatioyksikkö, mikä?
- ☐ Työryhmä tai yhteistyöelin, mikä?
- ☐ Yksi vastuuhenkilö, kuka (tehtävänimike)?
- ☐ Projektikohtainen organisaatio
- ☐ Osana laatujohtamistoimintaa
- ☐ Osana muuta kehittämistoimintaa
- ☐ Toimintaa ei ole muodollisesti organisoitu yrityksessämme.

4. Mitä liiketoimintaprosesseja yrityksessänne on tunnistettu?

Kirjoittakaa vastauksenne alla olevaan taulukkoon kohtaan **4.**

5. Mihin seuraavista luokista liiketoimintaprosessi mielestänne lähinnä kuuluu?

a. *Ydinprosessi*

b. *Tukiprosessi*

c. *Johtamisprosessi*

d. *Liiketoimintaverkoston prosessi*

Merkitkää rastilla prosessityyppi taulukkoon kohtaan **5.**

6. Mitkä yrityksenne liiketoimintaprosesseista on valittu uudistettaviksi?

Mikäli mahdollista, merkitkää taulukkoon **uudistamisjärjestys** kohtaan **6A**, **aloitusajankohta** kohtaan **6B** ja **valmistumisajankohta** kohtaan **6C.**

7. Mitä yrityksenne toimintoja kyseiseen liiketoimintaprosessiin sisältyy?

Merkitkää rastilla kyseiset toiminnot alla olevaan taulukkoon kohtaan **7.**

Mikäli liiketoimintaprosessiin sisältyvää yrityksenne toimintoa ei ole listassa, voitte tarvittaessa kirjoittaa sen taulukon lopussa olevaan tyhjään tilaan.

Nro	4. PROSESSIN NIMI	5. PROSESSITYYPPI: Ydinprosessi	Tukiprosessi	Johtamisprosessi	Liiketoiminta-verkoston prosessi	6A. JÄRJESTYS (1, 2, 3...)	6B. ALOITUS (kk/vv)	6C. VALMIS (kk/vv)	7.TOIMINNOT: Yleisjohto	Tuotanto	Tietohallinto	Myynti	Markkinointi	Tuotekehitys	Taloushallinto	Logistiikka	Asiakkaat	Toimittajat	Yhteistyökumppanit		
1																					
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					

8. Mitä perusteita yrityksessänne käytettiin päätettäessä

a) uudistettavista liiketoimintaprosesseista?

b) liiketoimintaprosessien *uudistamisjärjestyksestä*?

Esittäisimme mielellämme joitakin hankekohtaisia kysymyksiä uudistamishankkeiden vastuuhenkilöille kysymyslomakkeen muodossa. Mikäli mahdollista, valitkaa edellä mainitsemistanne liiketoimintaprosesseista kaksi, joiden uudistamishankkeista yrityksenne voi antaa tarkempia tietoja. Kaikkia antamianne tietoja käsitellään luottamuksellisesti.

<u>HANKE 1.</u>
Liiketoimintaprosessin numero (ed. sivun taulukon mukaisesti): 1 2 3 4 5 6 7 8 9 10

Vastuuhenkilö:____________________

Tehtävänimike:____________________

Osoite (mikäli eri kuin edellä):____________________

<u>HANKE 2.</u>
Liiketoimintaprosessin numero: (ed.sivun taulukon mukaisesti) 1 2 3 4 5 6 7 8 9 10

Vastuuhenkilö:____________________

Tehtävänimike:____________________

Osoite (mikäli eri kuin edellä):____________________

Olkaa ystävällinen ja palauttakaa kysymyslomake edellä olevaan osoitteeseen viimeistään 27.3.1995 mennessä. KIITÄMME VAIVANNÄÖSTÄNNE!

Appendix 2

BPR '95 - tutkimus, Mail Survey Questionnaire, Second Phase.

9.6.1995

Hyvä liiketoiminnan uudistamishankkeesta vastaava,

Helsingin kauppakorkeakoulu on käynnistänyt liiketoimintaprosessien uudistamista koskevan tutkimuksen, jonka tavoitteena on muodostaa kokonaiskuva sen yleisyydestä, kohteista, toteutustavoista ja saavutetuista hyödyistä maassamme. Liiketoimintaprosessien uudistamisella tarkoitamme tietotekniikkalähtöistä liiketoi-mintaprosesseihin kohdistuvaa merkittävää parantamista. Sen yleisesti käytettyjä englanninkielisiä vastineita ovat mm. Business Process Reengineering ja Business Process Redesign.

Tutkimuksen ensivaiheessa kohderyhmänä oli suuryritysten tietohallinnosta vastaava johto ja sen avulla selvitettiin liiketoimintaprosessien uudistamisen tilanne Suomessa. Nyt toteutettavassa tutkimuksen toisessa vaiheessa toivomme saavamme teiltä apua merkittävien hankkeiden tarkempaa analysointia varten. Tutkimuksen kohteena ovat nyt liiketoimintaprosessien luonne, uudistamisen tavoitteet, uudistamishankkeen toteutustavat sekä saavutetut hyödyt. Yhteystietonne olemme saaneet yrityksenne ylimmältä tietohallinnosta vastaavalta johdolta.

Toivomme, että edesautatte tutkimuksemme onnistumista ja vastaatte mahdollisimman pian, kuitenkin viimeistään 31.6.1995 palauttamalla oheisen kyselylomakkeen osoitteella:

BPR'95 - tutkimus
Prof. Ari P.J. Vepsäläinen
Helsingin kauppakorkeakoulu
Runeberginkatu 14-16
00100 Helsinki

Tutkimuksen valmistuttua lähetämme kaikille vastanneille yhteenvetoraportin tuloksista. Luonnollisesti kaikkia tietoja käsitellään luottamuksellisesti, eikä mitään yksittäisiä tietoja tulla julkaisemaan.

Tutkimusterveisin

Ari P.J. Vepsäläinen, Ph.D.
Professori
Logistiikka

Timo Saarinen, KTT
Apulaisprofessori
Tietojärjestelmätiede

BPR '95 - tutkimus

A. UUDISTAMISHANKKEEN KOHDE

1. Kuvatkaa lyhyesti uudistamisen kohteena ollutta liiketoimintaprosessia ja sen toimintaa:

a) *ennen* uudistamista

b) uudistamisen *jälkeen*

2. Mikä oli uudistamishankkeen

a) aloitushetki (kk/vv):____________

b) lopetushetki (kk/vv): ____________

3. Mihin seuraavista luokista uudistettu liiketoimintaprosessi mielestänne lähinnä kuuluu?

- ❒ Ydinprosessi
- ❒ Tukiprosessi
- ❒ Johtamisprosessi
- ❒ Liiketoimintaverkoston prosessi

4. Mitä seuraavista yrityksenne toiminnoista kyseiseen liiketoimintaprosessiin sisältyy?

- ❒ Yleisjohto
- ❒ Tuotanto
- ❒ Tietohallinto
- ❒ Myynti
- ❒ Markkinointi
- ❒ Tuotekehitys
- ❒ Taloushallinto
- ❒ Logistiikka
- ❒ Asiakkaat
- ❒ Toimittajat
- ❒ Yhteistyökumppanit
- ❒ Muu, mikä? ______________
- ❒ Muu, mikä? ______________

5. Mainitkaa seuraavat ominaispiirteet uudistamishankkeen kohteena olleesta liiketoimintaprosessista:

	Ennen uudistamista	Uudistamisen jälkeen (mikäli muuttuivat)
a. Prosessin omistaja (henkilö tai organisaatioyksikkö, joka vastaa prosessin toiminnasta):		
b. Prosessin tuotos (tuote tai palvelusuorite):		
c. Prosessin tuotoksen käyttäjä (ulkoinen tai sisäinen asiakas):		
d. Käyttäjän tuotokselle asettamat vaatimukset (esim.laatuvaatimukset, alhainen hinta, tms.):		

6. Kuvatkaa lyhyesti keskeisiä muutoksia (työtehtävät, organisaatiorakenteet, tietotekniikka) uudistetussa liiketoimintaprosessissa:

7. Missä määrin liiketoimintaprosessia uudistettaessa tapahtui muutoksia seuraavissa tekijöissä:

	Ei lainkaan	Vain vähän	Jonkin verran	Melko paljon	Erittäin paljon
a. roolit ja vastuualueet muuttuivat	1	2	3	4	5
b. työtehtävien sisällöt muuttuivat	1	2	3	4	5
c. vaadittava tietotaito muuttui	1	2	3	4	5
d. vaadittavien resurssien määrä muuttui	1	2	3	4	5
e. johtamistapa muuttui	1	2	3	4	5
f. mittarit ja kannustimet muuttuivat	1	2	3	4	5
g. organisaatiorakenteet muuttuivat	1	2	3	4	5
h. tietojärjestelmät muuttuivat	1	2	3	4	5
i. yhteiset arvot muuttuivat	1	2	3	4	5
j.vaadittava tietotaito muuttui	1	2	3	4	5
k. yrityksen toimintatapa muuttui	1	2	3	4	5

B. UUDISTAMISHANKKEEN ALOITTAMINEN JA TAVOITTEET

1. Mitkä seikat vaikuttivat uudistamishankkeen aloittamiseen?

- ☐ Uuden teknologian tarjoamat mahdollisuudet
- ☐ Liiketoimintaympäristön tai kilpailutilanteen muutokset
- ☐ Yrityksen taloudellinen tilanne
- ☐ Liiketoimintaprosessien uudistamisen kokeileminen yrityksessä
- ☐ Aktiivinen strategisten etujen tavoittelu
- ☐ Ongelman tunnistaminen liiketoimintaprosessissa, mikä?____________________
- ☐ Jokin muu syy, mikä?____

2. Kuinka suuret olivat hankkeen kokonaiskustannukset (karkea arvio, mk)?

Kokonaiskustannukset ______________, joista
Henkilökustannukset ______________ %
Laite- ja ohelmistokustannukset ______________ %
Muut kustannukset, mitkä? ______________ %

3. Mitä tavoitteita uudistamishankkeelle asetettiin ja kuinka hyvin ne toteutuivat?

Tavoite:	**Tavoitteet toteutuivat:** Erittäin huonosti	Melko huonosti	Osittain	Melko hyvin	Erittäin hyvin
1 ________________________	1	2	3	4	5
2 ________________________	1	2	3	4	5
3 ________________________	1	2	3	4	5

C. HANKKEEN PROFIILI

1.Kuinka hyvin seuraavat väittämät kuvaavat hanketta? Merkitkää väittämän kohdalle kuinka hyvin se mielestänne kuvaa hanketta.

Väittämä	Kuvaavuus				
	Täysin eri mieltä	Jonkin verran eri mieltä	En osaa sanoa	Jonkin verran samaa mieltä	Täysin samaa mieltä
Hankkeen luonne					
Hanke oli yrityksen kannalta merkittävä.	1	2	3	4	5
Hankkeen tavoitteet olivat kunnianhimoiset.	1	2	3	4	5
Hanke keskittyi liiketoimintaprosesseihin.	1	2	3	4	5
Hankkeessa pyrittiin olemassaolevien prosessien parantamiseen.	1	2	3	4	5
Hankkeelle asetettiin rajoitukset ja ratkaisumallit etukäteen.	1	2	3	4	5
Toteutuksesta vastaava ryhmä					
Uudistamishankkeella oli ylimmän johdon tuki.	1	2	3	4	5
Toteutusryhmän kokoonpano huomioi kaikki hankkeen osa-alueet.	1	2	3	4	5
Toteuttajilla oli riittävästi valtuuksia hankkeen läpiviemiseksi.	1	2	3	4	5
Tietotekniikasta vastaava osasto pystyi vastaamaan hankkeen haasteisiin.	1	2	3	4	5
Päättäväisyys hankkeen loppuun viemiseksi ei horjunut.	1	2	3	4	5
Hankkeen toteutus					
Hanke koostui toistuvista prosessiparannuksista.	1	2	3	4	5
Hankkeen aikataulut eivät venyneet merkittävästi.	1	2	3	4	5
Hanketta varten allokoidut resurssit olivat täysin riittävät.	1	2	3	4	5
Olemassa oleviin toimintoihin ja rakenteisiin sitouduttiin.	1	2	3	4	5
Muutosjohtaminen oli oleellinen tekijä hankkeessa.	1	2	3	4	5
Organisaatio ja henkilöstö					
Prosessin uudistaminen ei vaatinut organisaatiorakenteiden sopeuttamista.	1	2	3	4	5
Henkilöstöön liittyviä tekijöitä pidettiin oleellisina.	1	2	3	4	5
Ihmisten uskomuksiin ja arvoihin kiinnitettiin erityistä huomiota.	1	2	3	4	5
Tietotaitotason kasvattamiseen pyrittiin.	1	2	3	4	5
Muutosvastarintaa ei esiintynyt.	1	2	3	4	5
Muut tekijät					
Hankkeessa keskityttiin vain kohteena olevaan liiketoimintaprosessiin.	1	2	3	4	5
Tietoteknisen infrastruktuurin uudistaminen ei ollut tarpeellista.	1	2	3	4	5
Organisaation ulkopuolisilla tekijöillä ei ollut vaikutusta.	1	2	3	4	5
Yrityksen kulttuuritekijät huomioitiin hankkeessa.	1	2	3	4	5
Samaan aikaan oli käynnissä useampia uudistamishankkeita.	1	2	3	4	5

D. TIETOTEKNIIKAN KÄYTTÖ JA VAIKUTUKSET PROSESSISSA

1. Mikä oli tietotekniikan käytön merkitys ja sen vaikutukset seuraavien tekijöiden osalta?

	Ei lainkaan	Vain vähän	Jonkin verran	Melko paljon	Erittäin paljon
Kuinka suuria *rajoituksia* yrityksen olemassa oleva tietotekninen infrastruktuuri asetti tietojärjestelmien toteuttamiselle?	1	2	3	4	5
Kuinka suuria *muutoksia* jouduttiin tekemään yrityksen olemassa olevaan *tietotekniseen infrastruktuuriin?*	1	2	3	4	5
Kuinka suuria *muutoksia* jouduttiin tekemään *yrityksen olemassaoleviin tietojärjestelmiin* hankkeen tietoteknisten vaatimusten vuoksi?	1	2	3	4	5
Kuinka monia *täysin uusia tietojärjestelmiä* jouduttiin kehittämään prosessia uudistettaessa?	1	2	3	4	5
Kuinka suuria vaikutuksia tietojärjestelmillä on uudistetun prosessin toiminnassa?	1	2	3	4	5

2. Mitkä tietotekniset ratkaisut (nimeä yleisellä tasolla esim. asiantuntijajärjestelmät, tietoliikenne, multimedia) olivat keskeisiä tietojärjestelmien toteutuksessa ja milloin ne on otettu käyttöön ensimmäisen kerran a) yrityksessä ja b) toimialalla?

Tietotekninen ratkaisu:	Otettu käyttöön (kk/vv) yrityksessä	toimialalla
1 ________________	________	________
2 ________________	________	________
3 ________________	________	________

3. Mitä seuraavista tietotekniikan tarjoamista mahdollisuuksista hyödynnettiin liiketoimintaprosessia uudistettaessa?

- ☐ Tietoriippuvaisten työtehtävien automatisointi
- ☐ Työtehtävien poistaminen
- ☐ Tehtävien ja/tai prosessien integrointi
- ☐ Tehtävien ja/tai prosessien samanaikainen suorittaminen

- ☐ Tiedonvälitykseen tarvittavien välikäsien poistaminen
- ☐ Tiedon keruu ja jakaminen
- ☐ Tiedon analysointi ja päätöksenteon tukeminen

- ☐ Kokemusten ja osaamisen tallennus ja kertyneen tiedon hyväksikäyttö
- ☐ Toiminnan riippumattomuus ajasta ja paikasta

- ☐ Prosessien ja tehtävien seuranta
- ☐ Prosessien mallintaminen ja käsitteistäminen
- ☐ Muut mahdollisuudet, mitkä?

E. HANKKEEN ONNISTUMISEN JA VAIKUTUSTEN ARVIOINTI

1. Kuinka hyvin hanke mielestänne onnistui?

	Erittäin huonosti	Melko huonosti	Osittain	Melko hyvin	Erittäin hyvin
a. Hankkeen läpivienti	1	2	3	4	5
b. Tavoiteltujen muutosten toteutuminen	1	2	3	4	5
c. Muutosten avulla aikaansaatu toiminnan tehostuminen	1	2	3	4	5
d. Hanke kokonaisuutena	1	2	3	4	5

2. Mikäli mahdollista, mainitkaa kolme tärkeintä prosessin muuttamisesta saavutettua hyötyä.

Hyödyt
1 ______________________________
2 ______________________________
3 ______________________________

3. Mikäli mahdollista, mainitkaa kolme merkittävintä prosessin muuttamisesta aiheutunutta haittaa.

Haitat
1 ______________________________
2 ______________________________
3 ______________________________

4. Mikäli mahdollista, mainitkaa tekijät, jotka erityisesti edesauttoivat hankkeen onnistumista?

Onnistumisen edellytykset
1 ______________________________
2 ______________________________
3 ______________________________

5. Mikäli mahdollista, mainitkaa hankkeen toteuttamisen kannalta kolme merkittävintä ennalta tunnistettua riskiä. Merkitkää myös rastilla ne riskit, jotka toteutuivat hankkeen aikana.

Riskit **Toteutui**
1 ______________________________ ☐
2 ______________________________ ☐
3 ______________________________ ☐

6. Mikäli mahdollista, mainitkaa kolme *muuta* merkittäväksi ongelmaksi koettua tekijää hankkeen toteuttamisessa.

Ongelmat
1 ______________________________
2 ______________________________
3 ______________________________

7. Arvioikaa prosessin tehokkuutta seuraavien suoritustekijöiden osalta, mitkä olivat näiden tekijöiden suhteelliset muutokset prosessin uudistamisen jälkeen? Ympyröikää lähinnä oikea prosenttiluku tai kirjoittakaa skaalan ylittävä luku tyhjään tilaan.

Tekijä	**Suhteellinen muutos (%)**
Kustannukset	- -50 -40 -30 -20 -10 **0** +
Läpimenoaika	- -50 -40 -30 -20 -10 **0** +
Laatu	- **0** +10 +20 +30 +40 +50 +
Tehokkuus	- **0** +10 +20 +30 +40 +50 +

Olkaa ystävällinen ja palauttakaa vastauksenne alla olevaan osoitteeseen 31.6.1995 mennessä.

Palautusosoite:

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KIITÄMME VAIVANNÄÖSTÄNNE!